Of Copper-Work, Fielding, and Colour-making.

HAVING treated of the operations carried on within-doors, the writer now proceeds to his Suggeſtions on thoſe executed in the Copper houſe, and its appurtenances; or, as it is uſually termed, the work without-doors; in which, though not preciſely proper ſo to arrange it, he ſhall include Colourmaking, (1) from its affinity to Copper-work and Fielding; but in treating of theſe departments, where he addreſſes himſelf to the Workmen generally employed in them, he is aware of having to encounter prejudices of the worſt kind; for, to ſpeak freely in this caſe, as

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(1) Colour-making in ſome reſpects may be conſidered as among the firſt proceſſes, or at leaſt previous to printing (as obſerved elſewhere) but, as there may be occaſion to introduce various conſiderations with it, that, by their length, would rather break in upon what is exhibited as a ſeries of mechanical proceſſes, it will be ſpoken of in a ſeparate ſection further on.

well as he has hitherto done, (2) the generality of coppermen, and head fieldmen, and he will add, colourmakers, may be deemed as little acquainted with the principles of their reſpective branches, or indeed of being able to conſider them in any theoretical view, as laying a foundation for the practical part, as any other claſs, and perhaps leſs ſo, ſince moſt of them originally were little better than attendants in the copperhouſe, or colourhouſe; hence their conceptions go little further than to a certain mode of operation, the only one they have ſeen; and it naturally further follows, that good or bad, improveable or not, they rigidly adhere to it; or, to make uſe of a more common form of ſpeaking among ſuch perſons, they only proceed by weight and meaſure, (3) (ſimilar to many cutters not having an idea beyond the mere drawing, or printers beyond the pitch-pins) and according as they proceed in this formal manner, they conclude their judgments unimpeachable; and their operations perfect; and every ſuperior knows when once he has to contend with his Copperman or Foreman of the Field, he ſeldom gets any advantage by mere dint of argument; for where is there one who has been a long time in the buſineſs, but

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(2) See the Introduction, where ſuch freedom is apologized for. It may however here be added, that had the work been of a more general or public concern, ſuch particulars would probably not have been noticed.

(3) Weighing and meaſuring are in many caſes abſolutely neceſſary and convenient, but numberleſs circumſtances concur to render deviations from fixed or

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or impoſed rules oftentimes fully as neceſſary; and this it is that requires, as in every other proceſs, an underſtanding beyond a merely mechanical or practical one: As for ſpeaking ſo apparently lightly of Coppermen and Field Foremen, it is not from the agreeableneſs of it (and general poſitions will not hold good in every ſhape) but chiefly to induce ſuperiors not to be *very much* ſurprized, when they commit blunders; but, on the contrary, to conſider that it would be wonderful, from the reaſons adduced if they did not; and thus on that account, induce ſuch ſuperiors to exert themſelves the more to attain that kind of knowledge reſulting from a cloſe inveſtigation of the principles of each department, in order to enable them (as ſo often recommended in this work) to account for failures when they happen, and prevent their happening in future, what will ſay in ſuch a caſe ? that he has ſeen enough to know as well as any one.

As for copperwork, the principle of it is but ſimple, though the various circumſtances that occur in the practice render it really of conſequence ; the grand points depending on cleanlineſs, and the neceſſary degrees of heat, and if the obſervations on theſe objects be brought into ſome plan, and attended to in the operation by the copperman, he ſeldom is in very great danger of failing ; (5) nearly the ſame may be ſaid of the Foreman

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(5) Taking it for granted, that the preceding proceſſes are perfect, the drugs and other articles proper, and making allowance for accidents that the utmoſt carefulneſs cannot prevent, or what is ſtill more impoſſible to guard againſt, the wanton or miſchievous diſpoſitions of too many; ſimilar to what is ſaid in a note at the end of the ſection on pitches.—See likewiſe the hints offered to the colour-maker about printing, &c.

Speaking of accidents that cannot be guarded againſt. At a printing-ground in the country, it happened that for a long time moſt of the pieces that came off the parks were more or leſs ſtained of a yellowiſh caſt, and conſiderable was the loſs ſuſtained by it, and which could not be accounted for, till at

Foreman of a Field, his inſtruments are, ſunſhine, air, and water, and an attention to their effects on what is entruſted to his care, is to determine his proceedings.

It is not doubted but it may hurt many Coppermen and Foremen, that affect much conſequence, to obſerve, that in ſome principal grounds common men only are employed at the coppers, and even in the colour houſe ; the Superior himſelf or a Superintendant giving the neceſſary orders, and attending to the beginning and cloſing of each proceſs ; (6) not but that it is perhaps neceſſary

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length it was diſcovered that a Rabbit-warren being near the place, the rabbits in the night, in running over the parks, ſtained the pieces with their urine, or, perhaps more properly ſpeaking, the alkaline quality of the urine diſturbed the printed colours.

(6) The advantage ariſing from an attention of this kind by the Principal, is in reſpect to well-cleanſing the work, and the proper degrees of heat. To the credit of perhaps the firſt Printer in the vicinity of London, this is obſerved by him, and the end is accordingly anſwered ; for though the ſtile of work (to this time 1789) in reſpect to the drawing, &c. is not

neceſſary to have a principal perſon, where the buſineſs is on a ſcale ſufficiently large, in each of theſe departments, as well as in every other to receive orders, and diſpenſe the ſubordinate directions : (8) this, however, cannot always be done,

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not of the firſt rate, yet the brightneſs of the colours, and clearneſs of the ground ; in ſhort, the execution of it altogether, in reſpect to printing and colour, gives it a claim to much commendation.

(8) Principals do not always ſee it, but it rarely is the caſe where there is a chief copperman and foreman of the field, that they agree ; for one will interfere with the other's department ; and when any ill accident happens in the out door work, that cannot be eaſily accounted for, each is ready generally to lay the blame on the other ; though perhaps neither of them is in fault. Of which the following circumſtance may be a proof, as well likewiſe, as of that deficiency of knowledge ſo often complained of among workmen, from looking no farther than to their own immediate operations.

The pale red of a number of pieces being flown, when they were taken up, though the deep red was as it ſhould be ; an inquiry into the cauſe of it followed done, perſons proper for the occaſion not being always to be procured; neither is every Principal competent to diſtinguiſh thoſe that are ſo; but if he himſelf has a knowledge of the principles of the different departments, there is not much occaſion for leaving the whole of the proceſſes to others, provided he is not of that claſs who ſhrink from trouble, or expect to proceed without any cauſe for anxiety.(7)

Adverting

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lowed of courſe: The copperman laid it to the foreman of the field, and he laid it to the copperman; both of them veterans in the buſineſs; but it was plain neither of them could account for it, not being able to look beyond their reſpective ſituations; for the cauſe reſted in the pale red being ſightned with paſte, an allowance of adequate ſtrength not being given of the non-colouring drug, and the printer from a certain circumſtance hitting the ground but ſlightly, little colour was therefore imbibed by the cloth, and conſequently it ſoon flew off.---See colour-making.

(7) The writer here, according to the latitude he has allowed himſelf, of ſtepping out of the track to make remarks, cannot help obſerving, and wiſhes the obſervation may have weight where it is directed, which is, to thoſe who not bred to callico printing

or

Of Copper-work, Fielding, &c.

Adverting now immediately to the different proceſſes conſidered in this ſection, it is again obſerved, how difficult it ſeems to be to ſpeak of this work, or arrange the different articles in it, very methodically in regard to the proceſſes ſucceeding each

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or to any of the branches, precipitate themſelves into it, on a preſumption that their own natural ſagacity or general knowledge of buſineſs, will enable them ſoon to conduct it with eaſe and advantage: but, ſo complex is the buſineſs of callico printing, in comprizing ſo many branches that may be called diſtinct profeſſions, and thoſe branches running into other diviſions; that few who have been all their lives in it are equal to the management of it; to ſay nothing of the tediouſneſs of ſome of the proceſſes; the uncertainty that attends the ſucceſſive ſtages; the remoteneſs of time from the firſt operation to the laſt; the caprice of individuals or of faſhion; heavy expences, and other numberleſs inconveniences owing to its peculiar complicatory eſtabliſhment: hence, it may be ſaid with confidence, that not one in ten who has thus precipitately, or even deliberately, entered into it, without the neceſſary preparatory knowledge, but has ſoon found ſufficient reaſon to repent his ſo doing.

The obſervation may be even carried to the ſitueach other; for in one reſpect, the firſt article treated of ſhould be mentioned as preparatory to printing, but ſubſequent to it in another, ſo that the conſideration of colour-making, maddering, &c coming in between, muſt break any arrangement whatever, and from this conſideration, it was at firſt intended to ſpeak of bleaching as a diſtinct ſection, but being in callico printing ſo connected with the colouring part, and not ſo well underſtood as by the term preparation, it muſt be introduced as well as the circumſtance adduced will

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ation of thoſe who with a knowledge of the buſineſs enter into it, without being able to form ſuch connections as ſhall uphold it, and hence, as a word of advice, if it may be permitted to be given, let every one enſure ſuch connections before he enters in it, as it is not always found (as hinted before in a note in the ſection of pattern drawing) that good drawings and work anſwerable to them will alone be ſufficient, even if a large capital is not wanting. This idea could be purſued further, were it neceſſary, as it takes in the conſideraion of acquaintanceſhip, intereſtedneſs, dependancy, &c. which in every ſtage of life tend to form thoſe connections that mere merit will not always command.

will permit; and that ſeems to be, and which will accordingly be adopted, by introducing the principal operations with theoretical ſuggeſtions,& ſubjoining others, as notes, that are more diſtant. It is however apprehended that what is advanced will in general appear more like a deſcription of the proceſſes, than as an analyſis of them, or as reducing them into a ſeries of rules, like what has been done in the diſplay of the preceding articles, but here the circumſtance is different, as a number of common labourers are employed in each diviſion, taking the work continually out of each others hands, ſo that in fact there are as many diſtinct operations as there are operators, therefore a regular chain of rules cannot be laid down for each to obſerve; and if it were poſſible to arrange it as the writer wiſhes, or to bring the ſyſtem in all its parts into one point of view, it could only come under the cognizance of the principal, or whomſoever he appoints; and principals (as often ſaid) are not thoſe to whom this work is only addreſſed.

It may be proper to intimate, that in the Directions, &c. reſpecting the operative parts, thoſe points were chiefly attended to in which different practitioners nearly agreed; for, as two or three times obſerved, what renders the difficulty great in treating ſubjects of this nature, is, that the diſcuſſion appears no farther reaſonable or proper to any one perſon, than as it is reconcileable to his own ideas of practice; and there are ſeldom two who agree in the ſame mode; hence, it is endeavoured, rather than dwell upon certain little practical circumſtances, to give ſome general theoretical hints, as tending to convey what is ſo very much wanted among the majority of thoſe to whom this work is addreſſed, that is, ſome idea of the principles on which their operations depend, as ſuch a knowledge, if it can be conveyed, every one muſt grant will more lead an operator towards ſome perfection in his profeſſion, than merely exhibiting a heap of practical directions, or diſplaying a number of preciſe rules, as all the experience attained from long practice will never form the adept, without a theoretical knowledge.

Note, *In the following ſuggeſtions, phraſes and words not in common uſe, will be as much avoided as poſſible, and more familiar ones ſubſtituted*; *ſuch as* oily *for* oleaginous—thick or clammy *for* glutinous *or* mucilaginous,---various *for* heterogeneous, *&c. A Gloſſary will be however annexed, explaining thoſe words that could not with propriety be altered.*

Of Bleaching.

Or, as it is uſually termed Preparation.(10)

THOUGH Bleaching in a general manner as practiſed among profeſſed Bleachers, does not in every reſpect come under the conſideration of Callico Printers, it may not be improper to ſay two or three words concerning it ; two or three occaſional references to it will therefore be given, ſubjoined as notes, rather than by introducing them in the body of this work ;(11)

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(10) Meaning among printers that theſe proceſſes are neceſſary for preparing the cloth to be printed; hence in printing-grounds the terms bleaching or whitening is confined to laying goods on the graſs, and more particularly after printing. It is hardly needful to ſay that bleaching, ſtrictly ſpeaking, means whitening, by whatever method it is performed, therefore perhaps ſomewhat forcibly applied here, as it is not always that cloth ſent down wants whitening.

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(11) Wool, ſilk, flax, and cotton, poſſeſſing naturally an unctuous quality, it of courſe follows that they muſt undergo certain proceſſes, in order to diveſt them of that quality, or it will prevent their imbibing any colour (cotton, however, has this quality but in a very ſmall degree) and this proceſs is termed Bleaching, in general ; but as particularly applied, it is called ſcouring of wool, ungumming of ſilk, whitening of thread, &c. and for this purpoſe it is found neceſſary to uſe occaſionally acids or alkalies. Alkalies act moſt powerfully, becauſe the ſubſtance to be removed is of an oily nature ; and they are uſed either in a pure ſtate, or elſe as a ſoap. Acids are afterwards uſed, for the purpoſe likewiſe of whitening, and to clear the cloth or other body of what alkalies do not remove. For cleanſing wool, ſtale urine is made uſe of, which being alkaline, and combining itſelf with the oily quality of it, forms a ſoap, and produces the deſired effect. Silk, naturally of a yellow colour, is boiled in ſoap and water, rather than ſubjected to fixed alkali, becauſe of its being an animal ſubſtance, and hence more liable to be corroded ; it is likewiſe in general farther whitened

as what Callico Printers perform in this way is chiefly Aſhing and Souring, and in a manner rather peculiar to themſelves, as eſtabliſhed by cuſtom,

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tened by ſulphur. The whitening of flax, linen, &c. is however performed with fixed alkali, as the noxious ſubſtance is more difficult to be removed than from wool, or ſilk. Lime is uſed by many bleachers, though exploded by others, particularly in Ireland, from its cauſtic power, when uſed alone.

Sour milk. whey, or an infuſion of bran, or rye-flour, and other acids, ſuch as verjuice, lemon juice, &c. were formerly only in uſe, but oil of vitriol, marine acid, and other more modern improvements, have now the preference.

The antients cleanſed their wool with a plant called by Pliny, radicula, and by Linnæus, gypſophila Struthion, the ſame which is called in the ſhops ſoap wort, uſed likewiſe for fulling, and taking out various ſpots; it is ſtill uſed in ſome parts of Spain cuſtom, and, as may be ſaid of every profeſſion, adhered to more through its being ſo eſtabliſhed, than from the circumſtance of examining its propriety, according to natural principles, and eductions drawn from them; the arrangement of the proceſſes, as practiſed among them, will therefore be attempted to be diſplayed, as they precede each other; that is, where the articles intended to be printed are deemed needful to go through them; in ſome caſes (as may be repeated) they undergo but a partial bleaching; in others, particularly where goods are ſent down brown, or ſtained, they undergo as much as Callico Printers can give them; but, in any caſe, they at all times undergo more or leſs.

REMARKS

Spain, inſtead of ſoap; the pellitory and marine convolulus, may be uſed in the ſame manner.

A plant likewiſe was in uſe for whitening of linen, called the peplos, or white ſpurge, which grows in France; this and other plants of the ſame kind, abound with a cauſtic milky juice, that might anſwer inſtead of alkalies.—See more reſpecting the antients in the ſection of Colour-making.

REMARKS, &c. (12)

In the firſt inſtance, the pieces ſhould be properly ſorted by the Loftſman, that thoſe of nearly the ſame quality may be together; then let them be ſoaked all night, or longer, according to their foulneſs, in a receptacle entirely free from whatever might ſtain them, and ſo contrived, that a freſh ſupply of water may be admitted when neceſſary, and the foul drawn off, in order that any looſe ſtain or dirt that may have been contracted, be removed.

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(12) It is ſaid in a Treatiſe on Bleaching, that in the profeſſed practice of bleaching goods as they come from the loom, rye-meal, bran, or ley and water, is uſed in this proceſs of ſteeping or ſoaking, and thrown in warm to quicken the fermentation, which after a ſhort time will commence; and which will continue longer or ſhorter, according to the foulneſs of the goods, the ſtate of the weather, &c. when it is abated, or no more ſeems likely to be produced, they are taken out and waſhed, or the ſcum which ariſes in the operation, would ſubſide and damage them; the operation here, as well as in other fermentations, ſeems to be, that a degree of heat being raiſed, air bubbles are naturally created, cauſing that ſwelling of the liquid which requires ſuch force to keep the cloth down. It is added, that the apparent effect of the fermentation on the cloth is, that the air-bubbles in riſing, carry up with them ſome of the light oily particles, which remaining at the ſurface, produce a froth or ſcum, and which would, after the fermentation ceaſed, ſoon ſubſide and do much injury; the ſalts however being thus freed from their adheſion to the abſorbent earths, within the body of the cloth, are waſhed off by the internal motion, and the cloth conſequently becomes purer and whiter. This however is not the preſent practice in Ireland, or in Lancaſhire, as they are generally aſhed there as they come from the looms. Cotton having (as before ſaid) the leaſt of an oily quality, and being naturally white, is aſhed chiefly

The receptacle need not here be deſcribed, as every fieldman is acquainted with it; neither need it be ſaid that the cloth ſhould be ſecurely preſſed down; but it may be intimated, that the cover of wood laid over the cloth, ſhould not be of plain boards but cloſely perforated; and that it be rather ſecured by poſts placed betwixt it and the joiſts, than by weights laid on it, and thoſe weights very probably iron ones.

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for the purpoſe of freeing it from what is added to it, to prepare it for weaving.

Neither in the inſtance of ſoaking, is it quite proper, for though in being preſſed down, ſomething like fermentation might be incited, the foulneſs removed by that motion from ſome parts of the cloth, might ſtain others, before they aſcended to the ſurface, and mere warm water would have no effect in removing, oil, &c. It may be obſerved (ſpeaking of fermentation) the principle received of it, is, that the expanſive force of air, rarefied by the action of fire, or the mutual action of air and fire, is the univerſal cauſe. And to produce a fermentation it is needful that the ferment have ſomething acid and ſpirituous, and that it be in a ſpacious place.

Of Aſhing.[13]

OF this operation it may be ſaid, and in which conſiſts the Theory of Bleaching, that the articles uſed in it remove ſome ſubſtance from the cloth, which is the cauſe of the brown colour; and of courſe, by its removal, the cloth is rendered whiter and lighter, though how this is performed is but mere conjecture; whether by diſlodging the oily particles in the internal ſubſtance of the cloth, ſeparating the thick or mucilaginous ones, or otherwiſe altering its texture: —— that the oil is removed, is ſuppoſed to be the caſe from the property of alkalies, operating as diluents in oil; experiments having been made for that purpoſe, by examining the liquid in which aſhing has been performed; the reſult of which

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(13) This operation among profeſſed bleachers, is called bucking or boiling, and by them the cloth is laid down afterwards and watered; but with Calico Printers it need not be ſaid, they are only laid looſely on the graſs.

which was, that, after evaporation, an oily dark coloured ſubſtance was left, of an inflammable nature; and, on further experiments, it appears to be compounded of a viſcid oil, and the earthy particles of the flax.

It is thought by ſome, that bleaching with lime may be rendered advantageous; lime having more power in whitening than vitriol has, but (as juſt ſaid) at the ſame time it is more dangerous if uſed alone; but with about one part mixed with four of aſh, its cauſtic quality may not be ſo effective.

It is a remarkable circumſtance that ſome articles manufactured in India, and brought over unbleached, cannot be made white here. Another circumſtance is, that May Dew quickly whitens cloth, and of this it has been obſerved, that immenſe numbers of inſects are formed in the ſubſtance left after evaporation, and theſe undergo very rapid changes; but how far, or in what manner ſuch circumſtances affect the cloth, remains to be determined.

Of ASHING.

REMARKS, &c.

There is no need for this operation when goods are ſufficiently clear and white, and aſhing pieces that are ſo, can only be of ſervice to take out greaſe or any thing ſimilar to it; but when they are uniformly brown, or brown threads are here and there viſible, they certainly ſhould undergo the proceſs; therefore, in this caſe, give them a few ends in the aſh liquor, and attend the operation with great care, that it be effectually performed; for if it be not, it cannot be done by ſouring, much leſs by winching or planking; and if they are ſuffered to go to the madder copper without having undergone this proceſs ſufficiently, or if any greaſy or oily quality remain in them, (14) or if there be any part brown, the maddering cannot have its due effect; for, as that brownneſs is a particular ſubſtance in the cloth, that from its nature muſt prevent the ſtriking of the colour, no one need be told that the maddering muſt be imperfect, if it be not removed.

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(14) It once happened that ſo trifling a circumſtance as the ſkinning of a dog ſpoilt ſeveral pieces, they having been laid, after ſouring, on the place where he was ſkinned.

Take care that the water be not ſuffered to boil, before the aſh is put in, and in that ſtate it ſhould be continued ſome time, and the aſh ſhould not be put in till near the beginning of the boiling, let it then boil for about ten minutes or more, obſerving to ſtir the aſhes frequently from the bottom.

The ſtrength of the ley, and the gradation of heat muſt be well attended, that the texture of the cloth be not too violently acted on by the aſh; and the more effectually to imbibe it, it ſhould be opened by degrees; for ſimilar to common waſherwomen obſerving in putting linen, eſpecially body linen, into boiling-water, that it fixes the dirt; or, (what is to be ſure more remote) in culinary proceſſes, in order to boil vegetables green, not putting them into the water till it boils, ſo here it may be ſaid, the oily quality in the cloth would be in a manner cloſed up within it, by the cloth being immerſed in boiling water.

It is however neceſſary to be careful that the cloth is thoroughly dry before it is put in the liquor, otherwiſe the ley will not enter ſo readily into the body of it; for if it be wet the action of the ſalts will not be ſo powerful on the internal ſtructure, nor anſwer the purpoſe of diſlodging the filth by the aid of the water; but, on the contrary, will act more on the ſurface, and probably do the cloth ſome injury.

With coarſe cloths there may not be ſuch danger, through the water boiling before they are immerſed in it, as with fine ones, from the openneſs of the texture; but the precaution before given, is abſolutely neceſſary to attend where the texture of the cloth is fine or flimſy.

After this operation, the goods muſt be perfectly cleanſed from the aſh, by ſoaking them in a cradle, and winching them in a running ſtream, clear and free from any mineral impregnation; then take them to the planks, or ſomething ſimilar, till deemed ſufficiently cleanſed; next lay them down to whiten, and after being taken up, rince them, and get them ready for the ſour kettle.

Of Souring.

BLEACHING with ſour milk or vegetable acid, not being in uſe now among Callico-Printers, the mineral is here chiefly ſpoken of; of which mode it may be obſerved, that it unqueſtionably took ſome time to get into general practice, vitriol being of ſo corroſive a nature it might naturally be expected to injure the cloth very materially.

But experience has ſhewn, that by being properly weakened, generally ſo much that it is not ſtronger than vinegar, and may even be drank, that conſideration has therefore vaniſhed. As for vegetable acids, formerly ſo much in uſe, that cart-loads of lemons, crab-apples, &c. were frequently brought into printing-grounds, all contain a portion of oil that prevents the effect being gained ſo eaſily as by the vitriolic acid: The milk ſours in vogue among bleachers, likewiſe gives way to the vitriolic; for with this acid no fermentation happens in its not tending to putrefaction; but milk ſours naturally tending to corruption, if through inattention it ſhould happen while in contact with the cloth, it muſt damage it as well as undiluted vitriol; in fact, milk may be corrupted before it is uſed. Beſides, milk ſours take ſeveral days to perform its taſk, while vitriol ſouring is done in a ſpace of time no way comparative; but above all, its effect in whitening is the great point in its favour, the abſorbent particles in the cloth imbibing it ſo immediately, that the effect is very ſoon attained.

This operation, beſides contributing to the whiteneſs of the cloth, is deemed generally needful for the purpoſe of clearing away ſtains occaſioned by ink, iron, or other articles, which water alone would have little effect on; it likewiſe forwards the whitening of the cloth, when laid down after printing.

Of SOURING.

REMARKS, &c.

What article to uſe in this operation, whether mineral or vegetable acid, muſt depend a great deal upon diſcretion, or other circumſtances; vegetable to be ſure is now diſuſed among printers in this proceſs,(15) but ſtill the modes in uſe are ſo various, that any particular one cannot be inſiſted on; thoſe moſt uſually adopted are by the vitriolic and marine acids; the proportions moſt generally about 2 gallons of vitriol to a kettle or upwards of 100 gallons of water, and this quantity is enough for 8 pieces of 28 yard 4-4th wide, or the ſame number of pieces of 21 yards 5-4th wide; but this depends on the ſtrength of the ſpirit, and even on the goodneſs of the water; likewiſe the quality of the goods muſt be conſidered, chiefly in reſpect to the ſtrength of the warp, and theſe circumſtances are to regulate the time neceſſary for the proceſs(16); The heat of the water is alſo of conſiderable import, for if too hot it takes away from the acid its proper energy, as it is the acid only that is ſuppoſed to operate in this caſe, the water being uſed only for the purpoſe of weakening it. By the water being rendered warm the vitriolic particles muſt the readier enter the pores of the cloth, the

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(15) Except for the purpoſe of diſcharging colour when uſed in printing.

(16) Very various is the time, different coppermen, or their employers will allow; it is to be

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done in a quarter of an hour, but very frequently a conſiderable time longer is allowed; but a point to be obſerved, and which ought to regulate it, is knowing when the acid has had its utmoſt effect, for keeping the cloth in beyond that time, every one muſt grant is unneceſſary, and to a certain degree injurious. Similar to the above obſervation, it may be added, that the quantity of any article uſed in any of theſe proceſſes, is as much undetermined; and even the neceſſity of ſome of the proceſſes themſelves, but that ever muſt be the caſe, while drugs, and the articles they are employed on, are of ſuch different qualities, and the uſe of them governed by other circumſtances of œconomy, cuſtom, prejudice, &c. hence it is more ſafe to ſpeak in a general, than in a ſpecific or poſitive manner, and hence what is here ſaid of the proceſſes are called remarks, &c. rather than rules. Galling was formerly much uſed, but goods for printing being now of a ſofter texture, and a purer quality in general, it is nearly exploded.

the pores being by the action of the warm water rendered more open. (17)

If the ſouring be repeated, the acid ſhould be diminiſhed, from the texture of the cloth being opened by each preceding proceſs; ſo that the oily particles which blunted the acids are nearly removed, and the alkaline and abſorbent earths occaſioned by the aſhing, if aſhing were uſed, are eaſily waſhed out.

The goods then generally are cleanſed in a back lined with lead, and if they are not foul, the liquor may be uſed again in the kettle.

After theſe operations, they muſt be well cleanſed by winching and planking, or ſome other ſimilar proceſs, then run them between the ſqueezers, and as uſual hang them on the ſtakes, or in the drying-houſe, previous to being calendered. (18)

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(17) A Thermometer is certainly beſt for the purpoſe of aſcertaining the warmth of the water, ſome mens' hands being ſo hard, that their ſenſe of feeling in this inſtance can hardly be a criterion.

(18) In reſpect to the modes of cleanſing goods, it is amuſing to think of the various ones that have been adopted by battledores, ſtocks, waſh-wheels

Of SOURING.

For goods that are to be printed in chemical colours, or that are to be brought up in ſumach, or american bark, no preparation is neceſſary, unleſs the cloth is evidently too foul to paſs without.(19)

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and the like, moſt of which tend conſiderably to injure the cloth (this however is a circumſtance very likely not much deſired to be prevented by printers) but it does not appear abſolutely certain the effect is ſo much produced by ſuch violences as by the action of the water; hence the waſh-wheel may be ſaid to have the preference; the waſh-wheel, though, like other improvements of the day, has probably had its turn; for much miſchief may happen if it be not attended: The dumb planker or *wooden-man* now ſeems to have the preference. But after all, a plenty of water, with a good falling force, well directed, and the cloth kept in proper motion, would be better than any of thoſe violent methods, eſpecially if ſome goods be ſuffered to remain a little time in a ſoft ſoap ley, (of no very conſiderable ſtrength) and afterwards ſufficiently rinced and thoroughly dried.

(19) The complaint againſt colours brought up in ſumach, or bark, is that a good white is not procured no more than a good black (as ſpoken of before) and conſequently that courſe of work is confined to cloſe patterns. The writer however has ſeen a ſlight fielding uſed with ſucceſs, in light ground work.

Of Calendering.

REſpecting this operation, it has been intimated, how needful it is to be well performed, and that very much depends on it; it may however be here ſaid, that the chief care is to keep the weft as much as poſſible in the ſame ſtate as when woven, that is, in reſpect to the direction of the threads; the omiſſion of which, even when work is folded to go for ſale, is evident in many patterns. As for inſtance, if a piece be calendered ſo badly, that the threads lay all very obliquely acroſs the table, and the pattern be of a ſquare ſet kind, it muſt be clear that if printed on in ſuch a ſtate, and in the courſe of the following proceſſes the cloth gets into its original ſtate, the work will appear juſt in the ſame oblique direction, as the ſhoot of the cloth did when it lay on the table; and inſtead of the object being of a ſquare kind, it will appear more like a diamond, which is almoſt making a different pattern of it, and in the inſtances of ſmall ſprigs or other ſet objects, it muſt greatly tend to throw them out of ſhape and their proper diſtances.

The

Of CALENDERING.

~~The general inconvenience of calendering~~ in reſpect to printing is, that the cloth in paſſing between the rollers naturally ſpreads or expands more or leſs according to the cloſeneſs or eveneſs of the rolls; hence after printing, in proportion to the quantity of colour uſed, the cloth gets into its natural ſtate, and is generally found to contract the moſt lengthways, ſo that it is often very difficult to get grounds in, eſpecially if the print be long; and therefore it is deemed needful to ſtretch it, particularly when work off the graſs is to be performed.

In the operation of printing, which follows, an article is uſed that much concerns ſome part of the copper work, which is lamp black, other articles are uſed in ſightning, but none are nearly ſo pernicious, though all are hurtful in a degree; but ſomething muſt be uſed at times for that purpoſe; the conſideration of theſe articles however, come more immediately under the colour-makers department, and of courſe will be ſpoken of in another place.

Of cleanſing Goods,

previous to Maddering, or boiling off.

THE goods being now ſuppoſed to be printed, and properly ſtowed or dried, they are to be ſnitchelled or folded, and brought to the copper-houſe; which being done, throw them into a copper of bran liquor made warm, and winch them as quickly as poſſible, otherwiſe the colour may ſtart or run,(20) but this depends very much on the nature of the thickening or ſightning; for if either be of ſo looſe a kind, that it is quickly removed, the operation, it need hardly be ſaid, will be as quickly performed; but if of a contrary quality, it conſequently takes longer time; this circumſtance of the quality of the thickning or ſightning, is however not what every copperman looks at, or even ſometimes whether there be any ſighting at all, (21) though if the goods are properly and thoroughly cleared, it perhaps is little matter whether he knows the difference or not; but if he regulates his clearing by time, that is, by uniformly allowing ſo much time to a copperfull, let the thickning or ſightning be of any quantity or quality, he may be much deceived; for, (as ſaid before) ſome kinds of ſightning are more difficult to be cleared than others, as well as ſome kinds of paſte-work; or will bear the water more heated ;(22) hence in this caſe, a deal depends on the copperman's judgment, and in this inſtance it therefore behoves him to be attentive, as well as in the next operation of dunging, for if carried too far, in reſpect to heat, the certain conſequence muſt be ſome deſtruction to the work in boiling off.(23)

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(20) The term colour muſt in this caſe, be uſed here, as well as elſewhere, though improperly, it being, ſtrictly ſpeaking, the non-colouring article combined with the thickning or ſightning, for the colour is not produced till the work is in the copper.—See the note at the beginning of colour-making.

In ſome places the goods are put on a roll or winch before brought to the copper, and put into it, as turned off from the roll.

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(21) The vehicle (or thickening) for carrying the allum, &c. they muſt be ſuppoſed to know of, as there can be no preparation matter on the cloth for their proceſſes without it. A copperman, however, may be deceived in ſorting the pieces, as ſome with heavy ſightning may not have ſuch deep or heavy colour as others that have no ſightning.—See the article maddering.

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(22) Here is included the reſinous paſte uſed in printing, and where paper preſervatives have been uſed.

(23) With tender or pale colours it is a material matter that all the pieces of the ſame pattern be equally dried, for ſuppoſing a piece to be boiled off with a bare ſtowing and another of the ſame colour has been in a hot ſtove ſeveral days, there certainly is a chance of the colours of the two pieces varying.—See note 8 and more to this effect addreſſed to the colour-maker.

Of Dunging. (24)

THE uſe of this operation is ſaid to hinder the white part of the cloth, or that part wherever it may be, which is to appear white, being ſtained by the ſuperfluous colour, or according to the uſual phraſe of coppermen, it is to guard the colour, and prevent marking off: this however will not be the caſe if too many pieces, particularly if the work is heavy, be entered in the ſame copper, and which may very eaſily be accounted for, as it is poſſible the copper may contain, after ſome pieces are entered, beſides the dung, a ſolution of mineral and other ſalts, from the quality of the thickning or ſightning, or other ſuperfluous matter that may be diſſolved or diſunited in the copper; and which may mix with the acting power of the dung, and cauſe ſtains. In this operation, by letting freſh water into the copper, the encreaſe of the liquid will cauſe the foul ſtuff to run over.

Something likewiſe may be obſerved, reſpecting the dung itſelf, according as it is gathered in, whether as taken up in a freſh ſtate, or when dry, or having remained a long while on the ground;

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(24) It is thought the volatile alkaline particles of the dung, prevents the particles of the colouring drug from too copiouſly entering into the ground, (which is what is ſuppoſed to be meant by guarding the colour) and that of courſe they will chiefly be imbibed where neceſſary.

or whether in an almoſt liquid ſtate by rain or urine; as theſe circumſtances muſt more or leſs affect it in the quality; for, be the effective principle what it may, it certainly muſt vary according to the different ſtates in which it may be gathered: but whatever may be the caſe in that reſpect, care muſt be taken that the copper be not made too hot (as before ſaid) eſpecially if the dung be freſh and pure (if the word may be allowed) its effective quality being then of the greateſt power, and, if the paſte or ſightning be not entirely got rid of, the action of the dung will diſturb the colour, and prevent the madder from ſtriking as it ought.

As to the operation itſelf, after having filled your copper, proportion the dung to the work, in general, about 3 jets to 2 pieces, giving them about 40 ends in the copper, as quick as poſſible; the water that you impregnate with the dung muſt only be ſufficiently heated, in order gradually to looſen the colour; and as it much depends on the ſuperfluous matter being eaſy to be removed or not (as juſt obſerved) it muſt of courſe be carefully attended, and the proportions muſt be varied accordingly. After this operation, the goods muſt be winched and well planked, or otherwiſe cleanſed; they are then, according to

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the quality of them, to be ſumached, and then ſnitchel ed off, and waſhed.

In ſumaching, proportion the drug to the courſe of the work, for which, as is often ſaid, certain circumſtances prevent giving preciſe rules, (25) ſometimes indeed ſumach is not neceſſary, and ſometimes in common work it may be uſed with the madder, as it is ſuppoſed to aſſiſt it.

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(25) So here it may be ſaid, though weights and meaſures may be deemed ſtandards, yet coppers, pails, &c. cannot, as being of no regulated ſizes; and to ſay a little or a great deal, a proper quantity and the like, are but comparative terms, and conſequently indefinite.—See note 3.

Of Maddering.

TO ſpeak theoretically of this operation, is applicable to any other, where by means of ſome preparing ſubſtance, a colour is communicated to the cloth, that water nor any other liquid (not corroſive) cannot ſoften ſo as to remove, nor the action of the ſun reduce to a calx, or other ſtate, ſo that it eaſily goes off another way:

Of the Hypotheſes reſpecting the operation of fixing colour, none are deemed abſolutely deciſive and ſatisfactory, the theory however as generally accepted will be here diſplayed.

It is firſt of all noted, that the particles of whatever ſubſtance is uſed to colour any article, ſo that it is durable, are not ſoluble in either of the uſual menſtrums (26) whether water, ſpirits of wine, or alkaline lixivia; cauſed by their adheſion to certain gummous and reſinous ſubſtances, but are liable to be diſengaged by whatever has a greater coheſive power, ſuch as allum or tartar, to which the colorific particles of madder, woald, &c. adhere:---But in whatever manner ſuch ſaline articles act, they fix a colour, that, in general, can be no otherwiſe obtained; as to thoſe ſolutions which of themſelves form the colour without ſuch preparation, which ſome certain vegetables do, their effects are attempted to be accounted for, on a ſuppoſition that they contain a tenacious, glutinous, or other adheſive quality, with which the cloth, or whatever elſe it may be, being coloured, can never be removed, when once thoroughly dry: But it is ſuppoſed, in every colouring proceſs, by means of boiling, that the colouring particles find admiſſion into the pores of the cloth, which are opened by that operation being previouſly cleanſed by the preparatory ſalts, and that afterwards contracting

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(26) In menſtruums, or diſſolving liquids, three things are needed, 1ſt, that the parts of the body attract the particles of the menſtruum more powerfully than thoſe are attracted by each other

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other. 2d, That the body have pores adequate and open to the particles of the menſtruum; and, 3dly, That the coheſion of the parts be not ſo ſtrong, but that they may be torn aſunder by the violence of the diſſolving particles ruſhing together.

by the cold, they retain theſe particles; and which are further ſecured by a vitriolated tartar, lining them, as it were, with a cruſt or what is termed a coagulum, which coagulated matter is generated or produced from the allum, &c. conveyed to the cloth by printing, and the colouring particles they imbibe; this, as ſaid before, is the generally received idea: it is however here obſerved, that from what is hypothetically advanced, it ſeems as if heat were abſolutely requiſite to open the pores for the reception of the colouring particles, but in the inſtances abovementioned of the juices of ſome certain vegetables and other ſubjects, giving a perfectly faſt colour without heat, an objection ſeems to lay againſt it. (27)

Among other hypotheſes concerning the adheſion of colour two or three will be here mentioned, though the above it is clear muſt hold the firſt rank, at leaſt till a better can be adduced.

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(27) It is ſaid, 2 ſalts only will not diſſolve, when once chryſtallized. Tartar as it comes from wine caſks, and that made by a vitriolic ſalt, and one already alkalized, or which will become ſo when deprived of its acid. Dr. Lewis in his notes to Neumann's Chemiſtry, oppoſes this hypotheſis; it is likewiſe diſproved in the Chemical Dictionary, on a ſuppoſition that fixed alkalies will effect what is here ſaid, and that the vitriolated tartar can be diſſolved.—See obſervations reſpecting Indigo, the ancient purpura, &c. in the ſection of colour-making.

According to ſome, the fibres of cloth, ſilk, &c. are tranſparent tubes, into which the colouring particles entering are there formed into a kind of cruſt, plainly appearing through their tranſparent encaſement; others think theſe fibres are ſolid lengthways, but are outwardly full of little pores exceedingly cloſe to each other, into which the colouring particles enter and are there ſecured; while others think they are entirely ſolid, or at leaſt not provided with theſe cellular pores, but that the ſalts intended to ſtrike the colour corrodes them, ſinks into them, and unites with their colouring properties; or elſe, that the colouring is performed by a coagulation of the colourific matter itſelf, whatever that quality may be. Thus, it may be obſerved, ingenious men frame concluſions, formed undoubtedly upon reaſonable grounds, which from the confined portion of penetration that we have reſpecting the internal properties of things, they are glad to embrace ſooner than acknowledge an incompetency of knowledge: (28) however in regard to what is advanced above,the grand teſt is air and ſunſhine. But as in conſidering the article of colour-making there may be occaſion to ſpeak

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(28) In this, as in other caſes, it is impoſſible the mind can carry its powers ſo far into the internal

ſpeak

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ternal conſtitutions of ſubſtances, not obſervable by any phyſical operation, as poſitively to ſay, that ſuch things act on each other in ſuch a manner as tending to eſtabliſh the principles of any operation; therefore in ſuch caſes our reaſoning is only by inference. But, the further we go in our mental reſearches, we form more abſtract hypotheſes; till, at laſt, our inferences becoming almoſt fanciful, we talk of inviſible operations, and conſequently have recourſe to agents of an imaginary formation, to execute them.

This comment may probably ſeem preſumptuouſly trifling with the ſentiments of very great men, but whoever peruſes chemical works will find how freely each ſucceeding writer treats his predeceſſor reſpecting remote theoretical points. (See the preceding note, and notes 30 and 37 to colour-making where the theory of colouring cloth, &c. is diſputed) and the ſame may be obſerved reſpecting experimental proceſſes, in ſucceeding writers complaining of inaccuracy or miſtatement.

The above, however, muſt not be underſtood as invalidating

¶ invalidating

ſpeak further on this matter, little more will be ſaid here; what is advanced being deemed ſufficient as leading to the operation itſelf.

As the point of moſt concern in maddering is the quantity of madder uſed, it will therefore be ſpoken

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invalidating all theory, or ſetting aſide the principles of operations; the conſideration of which is, and will be particularly enſorced further on: but only as laying a ſtreſs on thoſe points that are not deemed ſubtleties. For notwithſtanding, the modern diſcoveries ſhew fire, air, water and earth, not to be primary ſubſtances, they may here be ſtill held as ſuch, as our practical knowledge muſt commence from their operations on other ſubſtances, deemed ſecondary ones, or as they enter into their compoſition: ſo, in the theory of colours, whatever may be ſaid of the nature of thoſe ſubſtances that help to produce them, reaſonable poſitions and practical knowledge can only commence from that point at which they begin to exhibit their effects.—See note 1 to the retroſpect at the end of colour-making.

N. B. In the preliminary ſuggeſtions to Fourcroy's Chemiſtry, the ſcientific contention above alluded to, among moderns ſpoken of, as well as the criterion that ought to determine it (which conſideration is equally applicable to aſhing and ſouring) (29) and is the more deſired to be noticed, as it is on this point that Coppermen as well as their Principals, ſeem ſo undetermined: ſome contending for the propriety of allowing plenty of madder, and others being as ſtrenuous for reſtricting the quantity; and conſequently neither can act with that certainty of effect which conſtitutes the value of any operation.

In the firſt place (according to the principles, which will be more fully diſcuſſed further on) it is not merely by allowing a large quantity of madder

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moderns reſpecting the new theories is diſplayed. See likewiſe an abſtracted view of the ſame, prefixed to the chemical compendium in the ſection of colour-making, and Note 9. to the ſame.

(29) This chemical or philoſophical mode of conſidering the matter, was intentionally avoided while ſpeaking of theſe operations (ſee the retroſpect at the end of colour making) for, in fact, it is of ſuch a nature, that few common coppermen can be ſuppoſed to have any conception of it, all they talk of is the *ſcald*.—See note 31 further on.

madder that the effect is the more enſured; but the grand point to decide it by, is the knowledge of that affinity or attraction one ſubſtance has to another. For here, the queſtion is, how far will the ſalt or aſtringent uſed in printing, act upon, or attract the colouring particles? (30) As to the liquid in the copper being apparently coloured, it is not in conſequence of the particles being to the higheſt

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(30) In the article of colour making, this is more fully treated. The writer however does not here affect to point out how to make thoſe diſtinctions, he only points to the neceſſity of conſidering about them, convinced that a Printer of a philoſophical turn, might turn what is ſaid to advantage. For though a ſcheme was abſolutely formed for that purpoſe, yet on reflection, as ſome might think it would be exhibiting too much, it was laid by, at leaſt for the preſent: but it may nevertheleſs be ſaid, that the proper criterion, is regulating the quantity of madder by the quantity of the aſtringent uſed; as according to the quantity uſed in printing any number of pieces, ſo ſhould be the quantity of madder, weld, &c. in proper proportion.

The above ſuggeſtions, it has been ſaid, are equally applicable to aſhing and ſouring; and on the ſame higheſt degree blended or ſaturated with it; (31) as they are only divided and ſuſpended, and muſt ſo remain till ſome other ſubſtance immerſed in that liquid attracts and retains them, in conſequence of being able to unite with them beyond the power which the liquid has. For, notwithſtanding ſome may ſay, there ſhould be a ſufficient

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ſame principles it is advanced by Dr. Home. See notes 3 and 7 to the Retroſpect, with the text belonging to note 3, that in ſouring among bleachers by profeſſion, the foulneſs, or rather the abſorbent earths left in the cloth after the alkaline proceſs (aſhing) ſo much attracts the acid particles, from having a greater affinity with them than with the water, that thereby the water at length becomes quite taſteleſs.

It is added, merely as a remark, this binding or fixing the colour, is reverſing the proceſs of preparation; as the liquid there, impregnated with a ſaline ſubſtance, attracts and joins the unctuous ſubſtance in the cloth; but here, the ſalts previouſly applied to the cloth, attract and join the unctuous colouring ſubſtance, ſuſpended in the water.

(31) For they cannot poſſibly unite with it to the point of ſaturation from their unctuous quality.

cient or equal impregnation of the water by the madder, whether work be light or dark, yet that can only be under a ſuppoſition that the particles fall and reſt on the aſtringent juſt as they would on any other place, only that they would be there fixed: but the aſtringent particles are here ſuppoſed to have a certain ſphere of attraction, acting on every colouring particle that comes within that ſphere, and uniting with it accordingly. Therefore the quantity of madder, whether the work be light or heavy, ſhould be according to what is likely to be attracted by the aſtringents, the reſt being conſequently ſuperfluous; which always muſt be, while the cloth is not all over impregnated with the ſalts, or the whole capacity of the copper not filled with the cloth: as in this inſtance, it muſt be clear there will be more colouring particles than will come within the ſphere or force of the attraction of the aſtringent particles.---See note 31 in the ſection of colour-making.

It may be obſerved that in ſome caſes without the uſe of preparatory ſalts, this attraction is greateſt with the cloth itſelf; but then the particles are not permanently fixed.---See notes 26 and 41 in the next ſection.(32)

In order to illuſtrate what has been juſt ſaid, ſuppoſe ten pieces printed with the ſame object, either large or ſmall, in deep red; ten more in the ſecond red; and ten more in the paleſt. Now here, it is not becauſe there appears the ſame body or maſs of colour in one as in the other, that an equal quantity of madder is neceſſarily alike for each ten pieces, for, if there be barely enough to bring up the paleſt, there will not be enough for the ſecond, and ſtill leſs for the darkeſt: and, inverting the rule, by having a ſufficient quantity to bring up the darkeſt, there will be more than ſufficient for the pale ſhades, and conſequently ſome madder will be waſted, from the attraction not being ſo ſtrong in the pale ſprigs, through their containing a ſmaller number of aſtringent atoms, as in the darkeſt ſprigs which have conſiderably more.

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(32) This wonderful property of affinity in Chemiſtry is deemed different from the Newtonian grand doctrine of Cœleſtial attraction; the former acting on ſmall particles proximate to each other, the latter on large bodies at great diſtances; and both theſe properties are diſtinct, in certain caſes, from terreſtrial attraction, the property of weight or principle of mechanics.

The above may be likewiſe inſtanced in a piece of pale blotch work, and a piece of dark; as in the dark blotch, there muſt be a greater number of aſtringent particles, and conſequently their powers of attraction more multiplied than thoſe in the pale blotch, from having a leſs quantity. In common engraved copper-plate work, this is evident in what is called the ſpewing of the colour; but it is particularly ſo, in the tinted work lately introduced; for whether done in black, chocolate, blue or olive, according as the colour is received by the cloth from the lightly tinted parts, it ſhews different ſhades; hence in theſe caſes, as the colour is not previouſly thinned, it can only be occaſioned by the aſtringent particles being more diſperſed than in the dark places, or in the grounds.

It may be ſubjoined that there are caſes where the copperman may be deceived in ſorting the pieces.--See note 21. Indeed it is here aſſerted, that the leading principle in copper work is properly ſorting them. As to the common wonder of printers, that pieces of the ſame pattern, colour, &c. do not come up alike, See colour making, under the article of the application of colour by printing.

Of Maddering.

REMARKS, &c.

In maddering, 3 certain diſtinctions ſhould be made, tho' the copperman as juſt ſaid, ſhould know how to make more according to the lightneſs or heavineſs of the work. The three alluded to, are dark grounds, cloſe covering work, and light grounds; but in this diſtinction it is impoſſible to aſcertain here what quantity of madder to uſe, as a copperman who has attended the previous proceſſes, if the cloth has been well managed in other reſpects (ſaying nothing about what has been juſt diſcuſſed) will bring up work with nearly half the quantity that ſome others will; for too many if left to themſelves, rarely deal out madder with a ſparing hand,(33) However, it may poſſibly be ſaid, if it be of a good ſpending ſort, heavy work may require ſeven or eight pounds to a piece, and for light work from four to ſix. But all this, as obſerved reſpecting aſhing, ſouring, &c. muſt depend on diſcretion or other circumſtances; for written documents cannot provide for every courſe of work.

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(33) At a certain Ground (the writer thinks Newton's) where madder is by no means ſpared, the Principal percieving one night a light near the Copperhouſe, found, on going thither, the Copperman in the drug-room, adding more madder to what had been weighed out for him; and it appeared, on enquiry, to be only for the purpoſe of inſuring his reputation as a Copperman, on the principle

As to the general mode of proceſs, according to the ſize of the copper, the courſe of work, or dimenſions of the goods, tie up more or leſs, rarely more than ten of light work, but leſs of heavy: bring the copper to a ſcald(34) in about an hour

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principle above mentioned, of thinking he could not uſe too much. It muſt be ſuperfluous to add, repeated circumſtances of ſuch a nature are of ſome pecuniary concern, eſpecially where much work is done.

(34) This term of a ſcald is much uſed by common coppermen, as they build their merit and certainty of effect on their judgment about it; and here undoubtedly they are right; though few preciſely know why: for in this proceſs, as well as in aſhing or ſouring, there is a certain inſtant of time when the

hour and a half, and keep it in that ſtate till the colour has ſufficiently riſen. With light goods this firſt ſcald will anſwer for ſumaching.

After this ſcalding, have them planked or waſhed, then enter them in freſh madder, and bring the water to a boil in about an hour; but great caution muſt be taken that the colour is raiſed

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the effect is accompliſhed, which, chemically ſpeaking, is the point of ſaturation, (ſee note 16) and to carry the proceſs on further muſt be injurious, or, at any rate, ſuperfluous; which point of time is when the noxious or obſtructive ſubſtance is decompoſed or removed; from an aſſimulation with the alkali or acid then uſed.

In the fixing of colour, it is when the combination of the ſalts and colouring particles is formed; for, as in the preparation, if there be any alkali or acid remaining in the copper, after the noxious ſubſtance is removed, it either has nothing to act on, or it muſt act on the cloth. So in maddering, or welding, if the cloth be kept in beyond the point of ſaturation, or the water be too hot, the red or the yellow will probably be dingy, or otherwiſe injured as well as the other colours, from the colouring particles acting with other powers, than their merely colouring ones. See note 16.

raiſed before the work is taken from the copper: and it may be obſerved that too much boiling will extract a brown from the madder itſelf, which of courſe muſt debaſe the work.

After this ſecond proceſs, have them waſhed, then bran them, and after being well waſhed in the ſtream, ſtrike them off in the barrow, and have them ſnitchelled up for the purpoſe of draining previous to being laid on the parks.

Branning is ſuppoſed to ſmooth the ſurface of the colour, by removing intervening particles that might render it otherwiſe.---See note 6 in the retroſpect. (35)

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(35) It is too common in the country, for purpoſes well known, to uſe logwood and brazi', and weld likewiſe in a mode not proper to diſplay; the work of courſe cannot be very reſpectable. But even this is better than the frequent fluſhed up colours, or thoſe pale ones, put in on a chymick principle, chiefly in work which is to be hurried up to town (ſee note 10 in the Retroſpect at the end of Colour-making) but theſe practices, it is hoped, for the credit of the buſineſs, are falling into decay,

After the proceſs of branning, the goods ſhould not be ſuffered to lay long in the heap, if they be, they muſt ſuffer from the fermentation that will naturally ariſe. (36) As to the proceſſes of ſumaching, woalding, &c. they being ſimilar in reſpect to ſtriking the colour, excepting that ſome

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as more fully obſerved further on. As to branning but a few pieces at a time, it certainly is an improvement; as among the modes practiſed in the country (at leaſt more ſo than about town) goods are frequently branned ſo much white (and bran liquor may be converted into ſours in a certain time) as to be deemed ſufficiently paſſable: and indeed in ſome cloſe covering kinds of work, the goods may be ſo much branned, as to need little if any graſſing: but then (as juſt ſaid) ſuch work will always be diſtinguiſhed from that which has a good white.— See note 37.

(36) A natural conſequence of a heap of vegetable matters, as well as animal, laying together, according to their humidity, and their acid or alkaline qualities, is a heat ariſing in the middle, which by degrees ſpreading more and more, will at length putrefy or rot them; this inteſtine motion diſintangling the acid or alkaline quality from the earthy and

ſome articles give out their tinging qualities very eaſily, it would be almoſt a repetition to ſpeak of them. In rincing and ſtreaming of pencilled and chemical colours, the chief conſideration is throwing them in quickly and keeping them in motion; and eſpecially in ſtreaming, that the pieces be kept as clear of each other as poſſible till the work be pretty well cleared.

Cleanlineſs

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and oily parts, that till then retained in them. Something like this happens in ſoaking white goods (as mentioned before) and it may here be added, that white goods as well as when finiſhed, ſhould not be piled up too damp, nor in too damp a place; and at any rate they ſhould be examined at times, or ſtains at leaſt will be the conſequence. It may even be ſaid, that the injury white goods may thus receive (as what are called mildews, are the firſt ſtages of putrefaction, or rottenneſs) may affect the preparation and printing.

The modern anti-phlogiſtic or pneumatic theory of Chemiſtry, including Dr. Prieſtly's celebrated diſcoveries, have thrown ſome light on the ſubject of putrefaction and its preceding ſtages; though ſtill it is far from being ſatisfactorily developed.—See the ſubject diſcuſſed by Fourcroy Vol. 3 —See likewiſe Higgins on the acetous acid, air, &c.

Cleanlineſs having been repeatedly mentioned, as a grand point of copper work, the copper man here is particularly adviſed to it in the firſt inſtance of ſupplying the copper with water, for if taken from ſome ſtreams, various matters may be brought down that may do conſiderable injury. And in ground reſervoirs or ponds, it ſhould be noted that there be no influx of filth of any kind, and eſpecially that they be not near ponds or other places where aſhed or ſoured goods are rinced, for fear ſuch foul waters find their way to them. (37)

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(37) Speaking of what may come down in a ſtream, the following circumſtance which happened ſome time ago is quite in point. As a number of pieces were rincing, printed in chymick colours, to the ſurpriſe of the rincer, he found the colours changed. The cauſe on examination appeared to be from a quantity of aſh and other matters from the clearing of the coppers, coming down with the ſtream from an adjacent dye-houſe.

As the purity or certain quality of water is of great conſequence, whether for Colour-making, Copper-work, or Fielding, it is juſt intimated, that its gravity being generally in proportion to its purity, the common hydrometer will diſcover it.—In Bergman's works, his experiments on waters, in order to remove impurities, and render waters fit for various purpoſes, are truly of importance to Callico-Printers, Dyers, and all who uſe conſiderable quantities of it; and in this caſe (as well as in others) if it were not from the fear of doing a particular injury, it could here be ſhewn, from experiments actually made by the writer himſelf, which Printing-grounds in the vicinity of London, are more or leſs fortunate in that reſpect.* In fact, it is matter of wonder this has not been more an object of enquiry among Callico-Printers and others, where the goodneſs of water is of ſome concern; eſpecially as little trouble and expence are required to render impure waters in certain caſes, and in certain quantities otherwiſe.

Perhaps the ſingular effects (as has been obſerved) of waters in India are owing to high degrees of purity, through a friendly interference of nature; and, as applicable to the ſubject, it is mentioned as no ſecret, that at a capital Printing-ground near town, the waters of a very copious ſpring, which for a time had been uſed for Fielding, were at laſt, by accident, found not to be ſo efficacious as the water that was rejected.—A Printing-ground could be even pointed out, where the waters are of a ſaline quality, and the ill effects even acknowledged.

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* *Among the works referred to, may be found the modes of doing it. If this is thought too expoſing, let thoſe who are not fortunate in this caſe, endeavour to remove the complaint; as the methods are there ſhewn.*

To philoſophical men it is juſt hinted, that probably the modern diſcoveries reſpecting air, might be turned to ſome advantage in nice operations, if the wonderful properties of water impregnated with fixed air, be conſidered. But to expatiate further on theſe points would be entering into too large a field, the reader is therefore referred to the works mentioned over-leaf, or advertiſed at the end, for that information which would be perhaps aukwardly exhibited here if compreſſed.* Theſe remarks however, muſt ſhew the uſefulneſs of philoſophy, and the advantage the arts acquire where its aid is obtained: and hence the ſuperiority of many operations on the Continent, where ſuch a combination is encouraged: indeed, the merely mechanic arts cannot aſpire to improvement without it, nor proceed with certainty, even in common operations, from the very obvious reaſon of its implying the neceſſity of thinking as well as acting.

Theſe obſervations likewiſe include the great neceſſity of regarding ſituation, particularly in forming Bleaching or Printing Grounds; for, as partly obſerved already, it is morally impoſſible to command brilliancy of operative effect, if (beſides what is above intimated) they lay under diſadvantages ariſing from denſe vapours, or groſs fuliginous matters, variouſly impregnating the contiguous part of the tmoſphere.—See ſomething to this effect notes 6 and 7.—In ſhort, without pure water, and pure drugs, operation is uncertain, and the effects diſcreditable.

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* *Some particulars will be found preceding the Compendium of Chemiſtry.*

N. B. Thoſe who deſire information on theſe heads, and others equally important, are here deſired to conſult Bergman's Chemical Eſſays on Air, Water, &c. Prieſtly on Air; Fourcroy's compendious ſtatement of General Theories and Experiments relating to them; Cronſtedt's Mineralogy; and Higgins on acetous Acid, Air, &c.

It is however here ſaid, that allum, ſaccharine acid, lime, galls, fixed alkali, &c. are the agents for detecting impurities in waters; it is likewiſe ſaid, however ſtrange it ſeem, that vats and other certain receptacles of waters ſhould not often be cleared from the green matter that gathers on the bottom and ſides. And this obſervation may be perhaps applied to ditches, ſo the ſedgy matter is not floating, nor liable to be taken up with the gittern, as it is ſaid to imbibe the phlogiſton from the air.—See Prieſtly particularly.

It may not be quite foreign to this ſubject to add, that Dr. Prieſtly ſays the air which he procured from a Callico Printing-ground (moſt probably the Printing-ſhop) was the moſt offenſive of all the ſpecimens that he procured from different manufactories.—See ſomething to this purpoſe in Percival's Eſſays on the air of Mancheſter.

Of Graſs-bleaching, or Fielding.

HAVING ſpoken of bran-bleaching or ſouring as ſubſequent to maddering, and obſerved (in a note) that by the improved mode of branning but a few pieces at a time, a white is almoſt procured without laying the pieces down (though that it need not be ſaid is not proper to be done in all caſes) it remains now to ſpeak of laying cloth down to clear the ground or other parts, from the ſuperfluous particles of colour; it is therefore obſerved that this effect appears to be chiefly accompliſhed by evaporation (35) and moſt effectually in ſun-ſhine and moderately windy weather, the heat of the ſun opening the pores and thereby giving egreſs to the colouring particles, detained in them till then; but in dull wintry weather, it is well known, the proceſs of whitening goes on very ſlowly; there being no power by heat to diſlodge thoſe particles; for without it, watering is inſufficient; the uſe of that operation being only to advantage when combined with the heat of the ſun; one power inſinuating itſelf into the pores of the cloth, and the other continually exhaling the watry particles, bringing away every time, ſome of the ſuperfluous colour, and leaving thoſe that by the action of the binding or contracting quality of the acids are with-held; though even theſe it is known, were the proceſs carried on too long, would be removed in ſome degree; eſpecially if the work conſiſt of pale or tender colours.

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(35) Perhaps inhalation by the air may be more proper, evaporation being more applicable to a chemical proceſs.

It has been before ſaid, that attention ſhould be beſtowed on the quality of the water, that it be light, ſoft, and free from filth; it likewiſe is neceſſary to attend to the quality of the ſoil of the field; for the facility and ſucceſs of the operation depend on the mutual action of heat and watering; therefore the drier the ſoil, or the more gravelly it is, the water will ſooner paſs through it, and the heat on the ſurface will not be ſo much oppoſed as otherwiſe.(36) Smoke or vapours from very foul boggy places, may be ſaid to be injurious, if frequent, and in great quantities.

It is noticed, that cloth does not get white ſo ſoon in windy weather as in ſtill ſunſhine; therefore, it appears that its influence penetrates the inward parts by its evaporating power, while wind only dries it, and in a manner prepares it for ſucceeding operations of watering; for wind alone, eſpecially if cold, would cloſe the pores of the cloth; but the power of heat naturally acts to the contrary; and in the caſe of evaporation, it ſeems the particles are partly diſlodged by water, and then finally drawn out as thoſe particles riſe up.

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(36) It is here offered as an opinion, that parks ſhould be ſloping from the middle.

In many places on the Continent, ſtrange as it may ſeem, the printed goods are never watered, and to this dry-bleaching it is owing that in moſt foreign printed goods, little colour is ſeen in the back, particularly in what is called Swiſs chintz; but then the texture of the cloth is unavoidably nearly deſtroyed.

It is a particular circumſtance to attend to in printing-grounds, where printed goods are watered (which the writer thinks is every where the caſe in this country) that the water be not hard, nor tinged by any mineral quality; one reaſon for not watering on the Continent, may be, the waters there abounding with mineral impregnations; indeed about London, work done in ſome places, is clearer in the white, from the ſuperiority of the waters; and it is well known the ſoil in general in the north, from its mineral quality, is unpropitious to producing a good white, and without a good white no work can appear perfect.—— See note 6.

That a deal depends on the ſoil and water is further evident in the caſe of foreign articles, particularly ſome from India; for at a place called Seconge, the waters have, it is ſaid, a ſurprizing tendency to whiten the cloth,(37) and of courſe to render the colours more brilliant, hence goods are brought thither from diſtant places for that purpoſe, as likewiſe to two or three other places on he ſame account

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(37) This may be conſidered philoſophically as well as merely mechanically, the ſenſation of colours being cauſed by certain reflected coloured particles, or rays of light ſtriking the eye, according as certain ſubſtances are diſpoſed to receive thoſe particles, thus, a bright colour lying by a dull one, the rays from each being intermixed with each other before they reach the ſight, the bright colour helps to enliven the dull one, and the dull one deadens the bright one, ſo in painting, it is not ſufficient that ſhadows be properly diſpoſed, but that every colour, according to its quantity or proximity to another, communicates a portion to the parts near it, receiving at the ſame time, according to the laws of reflection and refraction, a portion likewiſe from the other.

In managing the field-work, the great concern is to put thoſe kinds of work in the ſame parcels, that will take the ſame time to be brought white; that in fine open weather they are kept regularly watered, particularly work with delicate colour, and that the water be kept free from ſedge and other filth; the other common proceſſes of laying down,(38) pinning, taking up, drying, &c. every common fieldman is ſuppoſed to be acquainted with, and therefore dwelling on thoſe circumſtances is deemed unneceſſary.

Before this ſection is cloſed, it is repeated, and begged it may be remembered, that in reſpect to particular proceſſes, little is offered as poſitive, the difference of thinking and acting among different practitioners rendering ſuch confidence abſurd (ſee note 16) but here it may be ſaid, that the rejection or adoption of any mode of practice, is no further demonſtrative of propriety than as it is, or is not, in conſequence of a rational inveſtigation of the object, therefore thoſe who ſimplify any ſet of operations, (not from parſimonious views) but on the principle that nature univerſally obſerves in the ſources of her operations, is alone likelyto ſucceed, and (as particularly obſerved further on in reſpect to experimental colour makers) deſerves credit even if he be unſucceſsful; for certain it is, that in all mechanical operations, as well as natural (however complex they may appear) there is a ſimple point, on which they all move, or from which they ſpring and branch out, and from this conſideration the man of acuteneſs and reflection, whatever may be the ſubject of his employment, will trace every part through its connections and dependances to this firſt movement, this eſſential point, this actuating principle, and thence back again to its ultimate intended effects, endeavouring accordingly to remove what is ſuperfluous, and ſupply what is deficient; while on the other hand, the man who proceeds in the vague uninformed manner, ſo often reprobated in this work, ſoon feeling his deficiency in this requiſite chain of knowledge endeavours to compenſate for it, by repeated alterations of every kind, merely in the blind hope of accidentally ſtumbling on what is proper.(39)

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(38) It is a pity this part is not better attended to, than it is in general, in preventing the ill-effects of high wind, as a little extra trouble would accompliſh it, either by laying the work down in ſmall parcels, or by means of moveable laths or ropes, or trees, hedges, &c. placed as ſcreens.

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(39) Thus, in all chemical operations, they are to be traced to the agency of the four ſimple elements; and, to come quite home, in producing fixed colours on cloth; it is to be traced to the ſimple operation of an aſtringent.

Of Colour-Making.(1)

AS obſerved in the introduction to Copper-work, ſo here it is ſaid of this ſubject, that the chief intention in treating of it, conſiſts more in an attempt to enforce the conſideration of its principles, than in a wiſh to exhibit a number of recipe's or other ſimilar deceptive and ineffcacious modes of filling up this publication: It is however begged to be noted, that though in this light the ſubject is affected to be treated, it is not to be underſtood as addreſsed to the ſcientific reader only, for that would be equally uſeleſs in reſpect to thoſe to whom it is par-

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(1) There is no avoiding thus miſ-naming this operation, cuſtom has ſo eſtabliſhed it, for (as obſerved before) what is called colour-making is but preparing the means to procure the colour from the colouring materials (in dyeing it is really and properly called the preparation) and even in chemick colour-making, where there is not the proceſs of boiling, it is not always juſt; for even in that caſe the ſubſtance imparted to the cloth is not exactly what it will be in reſpect to colour when rinſed, or otherwiſe brought up; indeed ſome of thoſe caſes ſeems

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ſeems an inverſion of the proceſs, being, as in the inſtance of liming, brought up or ſtruck by a non colouring article.——See note 1, to Copper-work.

It is agreed that the art or myſtery of colouring various articles was in uſe among the ancients, and in ſome inſtances they excelled us, at leaſt it ſeems our mode of operation is but little different both in reſpect to preparation and finiſhing, though ſome parts of their knowledge is certainly loſt to us; it is however certain, that they uſed other ſubſtances to what are in preſent uſe; the preſumption of this being the caſe, is taken from the writings of very ancient authors, particularly the Greeks, and from ſome who have written expreſſly on the ſubject.

The Greeks, it is certain, diſtinguiſhed the operations of preparation and colouring, by terms exactly to the ſame import as with us, as relative to opening the pores of the ſubject of to be coloured, the conſideration of the colour, and then the fixing of it; and that in the practice aſtringents were uſed as amongſt us particularly directed; as Callico-printers and thoſe employed by them, have other conſiderations in plenty to attend, though people in general, and ſome theoriſts in Chemiſtry, think the whole buſineſs, or at leaſt the conſideration of it, is comprized in producing colours; but at preſent, moſt printers are contented with the mode as adopted in common, or elſe reconcile themſelves to it from not having either ability, opportunity, or inclination, to purſue it further; their view being to gain ſomething by what is known and attainable, rather than to devote much time to the uncertain effects of ſpeculation.

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us. From them it is probable it paſſed to the Romans, and their colour-makers or dyers (for here the terms are to the ſame meaning) made uſe of a ſpecies of fucus, which fixed the colours as firmly as is done by any modern proceſs; this plant is to be found in this iſland, it is, however, not deemed proper for whitening of linen.

The uſe of allum, tartar, lime, and other aſtringents were known to the ancients, though perhaps not exactly for the purpoſe we uſe them; what is ſaid of them could be introduced here at length, but for reaſons ſeveral times given, it is deemed ſuperfluous.

tion. Of Dyeing, it may perhaps be ſaid, the chief matter to ſtudy and practiſe is this article of procuring and conveying colours; but before colour is conveyed to the cloth in printing, there are proceſſes to be obſerved and to acquire a proper knowledge of, more difficult to attain than the mere art of colour-making, according to the preſent accepted practice of it; and in truth, to ſpeak from a certainty, the imperfections of printing, and even the miſcarriages of printers, originate as much, or more, from their inattention to other circumſtances or departments, or their ignorance of them, than merely that of colour-making. See the obſervations on putting on, and at the end of the firſt volume.

It is however certain, notwithſtanding, that from the great number who practiſe it, and with ſome reputation, who have very little acquaintance with chemiſtry, there ſeems perhaps no neceſſity for it; yet in order to attain a proper knowledge of the principles of this department, it is indiſpenſably neceſſary (particularly with the affinities of ſaline and metallic ſubſtances) otherwiſe the practice of it muſt be attended with conſequences vague, tedious, and unneceſſarily expenſive.

However, be this ſtatement conſidered as juſt or not, the writer, as he has all along affected to blend advice with precept, ſhall preface what he has to advance reſpecting the conſideration of colour-making, by addreſſing himſelf to thoſe who are attached to making experiments, without any principles to direct them, which negatively may be of ſome ſervice; as by pointing out what cannot be done, and wherein ſo many have bewildered themſelves, it may ſhew the fallaciouſneſs of certain operations, and in conſeqnence divert their attention from that mode, which ultimately will not anſwer the deſired purpoſe.

As to laying down rules for making colour, or exhibiting a great number of recipe's for that purpoſe (as obſerved more fully in other places) it would not avail much, but on the contrary, might do conſiderable injury, by throwing out a ſtimulus to numbers who vaguely dip into the practice of colour-making, particularly in chemical proceſſes; and hence too frequently dedicate their time and attention to what in the end bring diſappointment and regret.

As to the modes of imparting colour to the cloth, the conſideration of them is reducible to a ſmall compaſs, as it concerns the principle of colour-making for Callico-printers, their preparatory mixtures not running into that great diverſity, in reſpect to the number of ſhades, as among Dyers.(2) It may nevertheleſs be ſaid, that one part of Callico-printing is Dyeing, though not called by that name, notwithſtanding the colour is communicated but in a partial degree; dyeing being generally underſtood as colouring the whole extent of the ſubject, having previouſly immerſed it in the preparation liquid; but here a method muſt be uſed to convey this preparation (called colour, and by an operation called printing) to the cloth in certain lines, ſhapes and bodies, ſo that only ſhapes are viſible when the work is finiſhed; and here it is, that the ſkill of the Colour-maker is viſible; for though, by his memory or recipe's, he is informed that certain proportions of iron liquor, allum, ſacrum ſaturni, and ſo on, properly applied, produce certain effects; yet the many undeſcribeable circumſtances neceſſary to be attended to, render that department ſo extremely difficult to ſupport in a proper manner, that very few indeed are found adequate to it, (3) even where no attempts are made at improvements, ſearching for new colours, or more advantageous modes of mixtures; though in fact to attempt this (as hinted before) is the height of folly without a ſufficient knowledge of a chymical analyſis of what is already in practice; as without ſuch a knowledge, experiments muſt be inconcluſive, and there is little hope of advantage from them, but by downright chance; and this leads to obſerve on the many inſtances we have of ſuch experimental practitioners, and their little ſucceſs in proportion to the boaſts (4) that have been made of procuring durable colours by the ſimpleſt operations; that is, as muſt be underſtood by every one in the printing buſineſs, without being brought up in the copper; for it does not much enhance the value of that operator, who by ſome addition to the articles, with which another has produced a certain colour, or by ſome deviation, or retrenchment from them, if he can make it bear two or three more waſhings, for ſtill it cannot

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(2) It is not here meant that printers are to be reſtrained in this reſpect; they undoubtedly wiſh for as many colours as they can procure; but the difference alluded to is, as obſerved a little before in a note, that the mere producing of colours, as with dyers, is not their only object, Callico Printers having to exhibit a certain deſign, conſiſting of flowers, figures, &c. on the cloth, therefore, unleſs the writer is very miſtaken, here is certainly a difference.

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(3) See further on, where ſome hints are addreſſed immediately to the colour maker.

(4) Here the writer, in his uſual unreſerved manner, intimates the entertainment he has received when he has heard ſome Colour-makers in diſcourſe;

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courſe; what was generally advanced being mere boaſts of what each other knew beyond the reſt, without touching on the principles of colour-making, for almoſt every maſter printer and every colour-maker will ſay, and probably believes, he is poſſeſſed of ſome advantage in this caſe over every other; by which, to conſider it in a general manner, that is, in every one poſſeſſing ſomething extraordinary; it would ſeem as if on the whole nothing was wanting on this ſide perfection, but that is well known not to be the caſe; and it often happens, and every maſter Printer is appealed to for its truth, that when recipes have been purchaſed, it is rarely till after many experiments they derive advantage from them, and very often nothing can be made of them at any rate.

not be called permanent, though it may be deemed faſt enough.(5) But the principle of moſt chemick operations or falſe colours, being little more than certain ſolutions combined with certain ſubſtances; with which every dabbler in chemiſtry is acquainted with, it would appear like affectation to dwell much upon it; (6) every one of thoſe that make ſuch pretenſions will moſt likely talk highly of his recipe's and experiments; but great indeed is the experience requiſite to aſcertain the effects of chemick proceſſes, as that only can be done by bringing them into practice ſo as to execute a courſe of work with ſome certainty of the operations not failing.

It is far from the writer to wiſh to leſſen or diſcourage any laudable attempts toward any improvement, but thoſe whom he treats thus cavalierly, are of a claſs diſtinguiſhed in the printing buſineſs by an appellation too ludicrous to be here mentioned, as it is not likely much ſervice or improvement can be educed from their vague experiments; as for thoſe who proceed on rational principles, whatever may be the fate of their reſearches, they are, and ought to treated with adequate reſpect; but if they do ſucceed, their reputation muſt be in proportion, as little progreſs is yet made toward the point deſired in proceeding, even on the moſt ſcientific grounds.

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(5) This phraſe is in every chemical printers mouth, and ſome deem it ſo, and perhaps in ſome caſes it is ſo, if it will endure two or three waſhings.

(6) See at the cloſe of this ſection a few thoughts on the probable effects of an univerſally adapted chemical mode of printing, if it could be attained.

Purſuing this Idea further, ſome will undoubtedly ſay, who knows what may be produced from a number of experiments, if only by mere chance? as many diſcoveries originate more from accident than deſign; but ſtill, all this is not a ſufficient apology for making experiments without certain principles at hand to proceed by, for without them, the practice muſt be leſs pleaſant, leſs likely to be affective, and what is of great concern indeed, leſs likely to be attained with little expence; but here it unfortunately happens, that of the greater number of ſuch experimentaliſts, is included thoſe, who have a ſmattering of the practice from having been aſſiſtants to a colour-maker, or otherwiſe have caught the idea for the practice, and purſue it eagerly, though under every diſadvantage; another claſs is among principals themſelves, who having ingredients at hand, ruſh into the practice of combining and compounding one thing with another, juſt in the ſame manner, and upon the ſame uncertain grounds; the conſequence, undoubtedly, is much anxiety and embarraſſment, with very little benefit: as for the idea (juſt mentioned) of ſomething turning up by chance, that is too abſurd to give it countenance ſo as to recommend a ſeries of experiments from ſuch a hope; but advice in this particular it is apprehended will not be of much avail, moſt perſons in this caſe, imagining that if they have but opportunities of making experiments or ſeeing the reſult of them, or what is ſometimes worſe, getting together a number of receipes, they may ſave themſelves the trouble of ſtudying the theory or principles of what they undertake; for the idea of ſtudying and ſtoring the mind with certain regular ideas, carrying with it that of much labour and time uſeleſſly employed, very few indeed by choice enter into it: but waving all this, it may be ſaid, that even in ſuch a vague courſe of practice, it would not be ſo diſcreditable or unprofitable, if either claſs, juſt ſpecified, regularly made a point of tranſmitting to paper the ſequel of their experiments, (7) as even that would be of ſervice, ſince by ſo doing, they might, at all times, ſee where and how they have failed, or where they have gained any advantage, and accordingly might afterwards proceed upon ſurer grounds: but even this is ſeldom done, though at all times neceſſary, under every circumſtance, indeed it cannot be of much uſe, unleſs the minutes are accompanied with proper reflections on the probable cauſes of their failure or ſucceſs.

To all this it may however be ſaid, there are many who cannot attend to ſuch a mode; in fact ſome practitioners are hardly able to write, and

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(7) This brings to the writer's recollection his having read a book, he thinks called Marſhall's Minutes of Agriculture; which in point of utility to the farmer, is a thouſand times beyond a dry ſcientifical diſquiſition of the ſubject; as it contains a great number of obſervations apparently tranſmitted to paper as they occur, ſome of importance, and ſome but trivial, (or at leaſt as might appear ſo to many) but theſe practical obſervations, as ſuch, muſt be evidently of uſe, and the more ſo, as they are adapted to the capacities of thoſe for whom they were intended to be uſeful.

Principals have in general enough elſe to mind to dedicate much time for that purpoſe; hence is another reaſon why little benefit is reaped from ſuch a chaos of uncertain or inconcluſive experiments.

After dwelling upon this inconcluſive mode of practice and the conſequent circumſtances, it may not be improper, by way of illuſtration, to intimate in a general manner wherein ſuch practices fail, and then a word or two will be offered as recommending a properer mode of proceeding.

It is firſt obſerved, that the ſubſtances capable of producing colours, are almoſt infinite; ſo that the field being very large, the mere dabbler has too much opportunity of fruitleſsly making attempts: Some ſubſtances give out colours that can be removed by ſoap, ſome will oppoſe that, but cannot reſiſt air; and ſome cannot be moved by either; now reſpecting ſubſtances that are not permanent or faſt (according to the common phraſe) and known not to be ſuch by a number of experiments; ſome perſons have endeavoured to improve on them by joining a durable one to them; blending them as intimately as poſſible, from a preſumption that the weak ſubſtance would have received aſſiſtance from the other; but it has always followed that the falſe colouring ſubſtance ſoon flies off, leaving the permanent one behind: Some have endeavoured to procure a permanent one, by firſt putting on a fading one, and covering it afterwards with a permanent one, on a ſuppoſition that the permanent one would ſecure it, and by being externally ſituated, might defend that beneath it or within it, or at leaſt that it would operate in that manner for ſome time, ſo that there might be a little longer durability to the fading one, but this likewiſe will not anſwer; and in the practice of uſing acids, ſome by endeavouring to mix various ones together, without knowing their qualities or affinities, have found the effect of one deſtroyed by the effect of the other, like ſolution of tin and cream of tartar, or ſolution of tin and ſacrum ſaturni, as the marine acid will quit the tin and join the ſaccharim, the acetous acid being at the ſame time ſuſpended by it, is of no effect on the tin:— ſee experiments of this kind further on;—— others have had a notion that a mixture of different ſalts will keep the colours better; but it is proved to have a direct contrary effect: hence when they have acted in this manner, without any poſitive knowledge of the principles of this part of chemiſtry, they have made ſuch a confuſed mixture, that it was impoſſible to know which ingredient, or what number of ingredients cauſed the miſcarriage; much leſs to know in which was the efficacious property ſought after. Now, in this caſe, it may be further ſaid, a neceſſary circumſtance is omitted, and that is, firſt of all to try what effect each ſalt has on the colouring ſubſtance in regard to their ſimilarity of effect or appearance, for in knowing this, there is the greater chance of ſucceeding. But, if perſons will plunge themſelves into a practice of making experiments, let them begin with making them firſt, with ſimple ſolutions or extracts upon ſeperate vegetable or mineral ſubjects, making ſuitable remarks upon each reſult; though even that will not be ſufficient, unleſs the qualities of the ſolution are alike, or a previous acquaintance with them be obtained, ſo as to know their different effects in point of ſtrength, or time of operation; and this implies an abundance of food for obſervation, from the various mixtures that may be made only of one article uſed as a baſis, if conſidered in its different degrees of ſtrength or purity, and the different ſubjects it may have to act on. However, by proceeding in this ſimple manner, they may then unite or multiply them. But if they proceed here in too precipitate a manner, they will preſently be bewildered, as it muſt be clear from the above ſtatement, even to an indifferent perſon, into what numberleſs channels the ſimpleſt mixtures of ſimple ſubjects with each will run; and much more ſo when compound ones are taken; hence without ſome clue in this practice, the ſame indifferent obſervers muſt as plainly ſee, that ſuch operators muſt very quickly find themſelves in an inextricable labyrinth, hemmed in with doubts and difficulties, and if they proceed, it will be more from a ſhame of going back, than from a hope of getting into any regular channel.

In proceeding now to the intimation of a more proper mode of making experiments, it is premiſed, that the conſideration of colours (as may be ſuppoſed) is exhibited only as relative to printing, hence it chiefly alludes to thoſe that are permanent or fading, as applied to linen or other ſubſtances of the ſame kind.

By permanent colours, every one in the printing line conſiders thoſe that are not to be removed by ſoap, ſun nor air; the others are of various kinds, as ſome withſtand waſhings, but will fly on the air; others will withſtand neither, and others only for a little time; but what is of the moſt concern is, that, with few exceptions, thoſe colours that are the moſt permanent, are the leaſt brilliant; though for this, it may perhaps be ſaid, that entering but into the ſuperfices of the ſubject made uſe of, the colouring particles are more crouded together; and conſequently exhibit their rays more glowingly than if more diſperſed or ſeparated; which muſt be the caſe when entered (as is ſuppoſed in the caſe of permanent ones) into cells adapted to receive and retain them; and the more compound the colour is in reſpect to its ingredients, it is the leſs vivid, and leſs likely to be durable.

As, to what bold ſpeculatiſts, or even experienced practitioners may ſuggeſt, our knowledge of the nature of colouring ſubſtances is very limited; or if we know ſomething of any ſubſtance in one ſtate, that ſubſtance, when ſeparated, will preſent a new appearance in its ſeparated parts, and ſo on ad infinitium; hence, likewiſe is our knowledge very ſmall indeed in judging or determining on the reſult of thoſe applications of one ſubſtance with another, for the purpoſe of diſcovering or fixing of colours. In ſimple proceſſes, inſtances are very rare of permanency, but of any combination of ingredients, when one article ſeems to bid defiance to the great proofs of air and ſun, there is the object for inveſtigation; and therefore in colour-making, a great point is to diſcover thoſe articles that naturally poſſeſs thoſe permanently tinging qualities, or that can eaſily, and in the ſimpleſt manner be procured by a combination with ſome other.

As it is not certainly known, nor perhaps will it ever be, why ſome colours fade, and others will not, ſuppoſitions have been formed, ſpecious enough (as already exhibited) though they are received not as being indiſputable, but only as the beſt or moſt rational that can be given.

The moſt remarkable inſtance of ſimple ſubſtances for giving out their colour, as it were ſpontaneouſly, was in the tyrian dye, (8) which had power enough of itſelf, ſimply to communicate to ſilk and ſome other ſubſtances, a colour as firmly as can now be procured by any proceſs whatever: Other inſtances are in the ſolutions of indigo and ſilver; the latter when mixed with chalk turns the ſediment to a purpliſh black when expoſed to the ſun, or rather the action of the ſun's heat is the cauſe; the other circumſtance reſpecting indigo, is perhaps more known to callico printers, in the ſolution at firſt appearing green, but on expoſure to the air turning to a blue, as obſerved in another place.

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(8) In the Spaniſh ſeas is found a ſhell-fiſh that reſembles the antient purpura, the purple dye is in its throat; Cloth of Segovia is dyed with it, and bears a high price. The colour from the fiſh when firſt laid on linen, is a light green, which by the air is changed to a dark one—in a few minutes to a ſea-green—a little while longer into a blue—from that it turns to a purpliſh red—and in an hour or two to a deep purple; here the ſun has no more power, but by waſhing it in ſcalding water and ſoap, and drying it, the colour ripens to a beautiful bright crimſon.

The Americans of Peru and Chili had knots of wool, which by the variety of their colours ſerved for characters and writing; the knowledge of theſe knots was called *guipos*, and was one of their greateſt ſciences.

The Otaheiteans procure a beautiful crimſon by mixing the yellow juice of a ſpecies of fig with the juice of fern.

Having ſpoken of the vague and inconcluſive operations of many, the following diſplay of the inſtitutes of chymiſtry in view of eſtabliſhing one on a firmer baſis, is humbly offered, which will be followed by a few thoughts immediately relative to the practice of what is the ſubject of this ſection.

It has been ſaid, that an acquaintance with chemiſtry is indiſputably neceſſary for a colour-maker to have, but it muſt be underſtood not in every diviſion of it; as chemiſtry, in its extenſive ſignification, comprizes conſiderations that have little to do with the ſubject of this treatiſe; therefore the elementary parts and principles only will be juſt touched on, as leading to what is the principal object of it, that of prompting thoſe who look at this treatiſe, to purſue the enquiries it recommends towards attaining knowledge, rarher than expecting to find it in the work itſelf. Hence it is ſuppoſed as this little abſtract can quickly be peruſed, and eaſily retained, it may incite ſome, from the evident inſufficiency of it, to look further into the ſubject, whom otherwiſe the generally voluminous appearance of chemical treatiſes would have deterred.

From the above it may be ſuppoſed, that what is exhibited in the following ſketch, will be as free from conteſted points as poſſible, as well as being limited in the ſubjects of it. Therefore, notwithſtanding that, through the numerous diſcoveries made, and ſtill making, Air, Water, Earth, and Fire, are no longer deemed elements (Fire is deemed ideal) they will here be conſidered ſtill as ſuch, and the account as well as the reſt of the compendium, will be chiefly taken from Macquier; he ſtanding, as it were, in the mid-way between the old and the new theories (ſee Fourcroy's Chemiſtry in the Tranſlator's preface.

Here it would not be unpleaſant to dwell on the new diſcoveries and theories, as almoſt numberleſs tranſcriptions could be made, that, at leaſt, might amuſe : however, thoſe who are inclined to look into the moſt modern authors, will find a liſt at the end of the work, each of which contains more or leſs of what would not only entertain as theories, but as otherwiſe are practically proper for every Callico-Printer to conſult.(9) See maddering and the laſt note to it. But reſpecting Dictionaries and other ſimilar compilations, a few excepted, nothing is more fallacious (ſee note 40 to this ſection) from their nature containing little original matter, and few of the new diſcoveries. For ſo many have been the opinions and facts promulgated within the laſt 10 or 12 years, that authors however reſpectable before that period,

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(9) Among them will be found the means of rendering impure waters otherwiſe.—Detecting ſophiſticated allum, tartar, and other ſalts, with the diſcovery of new ones.—Various preparations of colours.—Experiments on Pruſſian blue, Indigo, &c.—a new green colour procured from phlogiſticated copper and arſnetical acid, &c. In the Mancheſter Philoſophical Memoirs, are enquiries in view of procuring new dyeing materials by Dr. Delaval,—on the uſe of acids in bleaching by Dr. Eaton.—The ſtate of the imitative arts among the Ancients compared with their preſent ſtats, by Mr. Thomas Kerſhaw, &c, &c.

riod, are in many points ſuperſeded; and Dr. Prieſtly himſelf declares, that theory itſelf is now unhinged, and Philoſophers have to unſtudy what they have been long labouring to acquire. Not but that the more this great arcana is pervaded, the more we diſcover of that wonderful connection of the whole; that rotation of effects, where nothing is diſplaced but its room is ſupplied; and that what is called deſtruction is only a preparative to new combinations and forms. *

The following are ſome of the modern innovations and facts, repreſented as briefly as poſſible, though far from being generally received. ---Phlogiſton, inſtead of reſiding in inflammable bodies is reſident in the Air, and is an element of Water.---Air contains phlogiſton and water.---Inflammable air reſolvable into water not ſmoak. ---Common air contains out of 100 parts, 27 pure, 73 phlogeſtic.----- Water tranſmutable into earth.--- Water contains phlogiſton and acid.---Ignition a ſubſtance put into a condition to imbibe phlogiſton from the air; bodies therefore by being burnt acquire weight..--- Vegetables exiſt by imbibing phlogiſton.---Certain

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* See this admirably exemplified in Fourcoy, vol. 4, on the ſubject of putrefaction.

tain green ſedgy matters purify water and keep it ſo.---In ſolutions of metals, the diluent or water is the ſolvent, and the metal decompoſes the acid. Several of the affinities are reverſed.(10) and Phlogiſton generally put at the top of each column.

In fine, the elements are now almoſt as much a ſubject of decompoſition as any other ſubſtances.

And here, to deviate from, or, perhaps, rather to enforce the ſubject juſt dwelt on, as it is offering a great counterpart of diſcovery, and by the contraſt, rendering what has been obſerved the more ſtriking; may it be exhibited as a reſpectful, and from the ſublimity of the circumſtance introduced, an aweful teſtimony that the preſent glorious epoch of knowledge tranſcends all previous human efforts; as taking all nature, as it were, into its graſp, and collapſing the extremes of creation? For, while philoſophy on one hand, burſting through the elementary barriers of nature, purſues her to her inmoſt receſſes and analyzes thoſe objects, whoſe minuteneſs confound the imagination, and which are only perceptible by their effects ; on the other hand, it not only adds new orbs to our ſolar ſyſtem, but darts into the immeaſurable expanſe and ſcrutinizes objects that as equally confound by their magnitude, and the ſpaces they poſſeſs ; in ſhort, it can be ſaid, it explores immenſity itſelf, gages the very Empyreum, and exhibits its conſtruction ! ! ! ! !--But of this ſtupendous effort, the writer dare not venture to ſay more, as the ſcientific analyzers of literature themſelves, while they ſubſcribe to the ſucceſs of it, follow the explorer with timidity, and inveſtigate his purſuits with aſtoniſhment! [*]

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(10) Not being generally known, and to ſhew that ſcientific diſcoveries, though not directly uſeful, may lead to what is ſo, it is ſaid here, that the reflections on the filling of Balloons, gave riſe to certain experiments on air.—It may be added for the above reaſon, that the effects of light on vegetable and other colouring ſubſtances is ſuch, as to give the Eaſtern countries their ſuperiority in that reſpect, as well as their original claim.

This erratic deſcant is therefore cloſed with informing the reader, the whole is to be found in the memoirs of the Royal Society, 1785, as delivered in by Dr. Herſchell; and the writer proceeds to the Compendium, beginning with the elements according to the poſitions juſt ſuggeſted; and firſt, of

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[*] In order to give perſons of confined information ſome idea of thoſe regions, the object of the above great Aſtronomer's reſearches, it may be ſaid the orbit of the Herſchel (originally named the Georgium Sidus) or the revolution it deſcribes round the ſun, is between 10 and 12,000 millions of miles ; or above 3000 millions in diameter. Now here let the reader ſtop

AIR,

Air it need hardly be ſaid, is that fluid which ſurrounds our globe, and pervades all bodies not filled with a heavier ſubſtance than itſelf. Its chief and diſtinguiſhing quality, and from which reſults the general effects of it, is its elaſticity or ſpring, or its property of expanſion and rarefaction, according to the preſence of fire and heat. Its weight is about 800 times lighter than water; or a quantity of water 1 cubic inch in bulk,

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ſtop and contemplate the magnitude of this ſpace, as occupied by the ſun and the reſt of the planets; or ſuppoſe it is ſaid a ſphere or globular object filling this ſpace.— Now let him compare this vaſt object or occupied ſpace, to the regions now exploring, containing millions of millions of ſuch occupied ſpaces, and it muſt appear as a ſpeck, a grain of duſt, or a point. But further, if he conſiders theſe regions as unlimited, then this vaſt object, or ſpace of above 10000 millions of miles in circumference, if compared to ſuch unlimited ſpace, muſt ſeem ſmaller than any particle of matter is (which tho' we know it exiſts, yet cannot perceive it by the moſt powerful microſcope) compared to this object of above 3000 millions diameter, or above 1000 millions in circumference!!!

will require 800 times that bulk of air to be of the ſame weight, taking the air in its common ſtate, the bulk as before ſaid, being continually ſuſceptible of change.

WATER.

THIS is a tranſparent and inſipid ſubſtance, and fluid or ſolid according as affected by heat or the privation of it; its natural ſtate is ſuppoſed to be ſolid, and rendered fluid only by heat; expoſed to actual fire, it acquires a certain heat (by boiling) beyond which the greateſt force of fire can never raiſe it; the effects of dilatation (as when a ſmall quantity is thrown upon metal in fuſion) are occaſioned by the air it is ſuppoſed to contain, and like air it enters into the compoſition of moſt bodies, except metals and minerals, as it is only ſuppoſed to be interſperſed between their parts, without entering into their compoſition.

EARTH.

THIS element is different from thoſe juſt mentioned, in being fixed; they being volatile, or eaſily ſeparated by the action of fire, from the bodies with which they may be united; hence earth abſolutely pure cannot be affected by any operation, and reſiſts the utmoſt force of the ſtrongeſt fire, being the caput mortuum, or that ſubſtance left after a chymical proceſs, which to all perception cannot afterwards be changed. Earth may however be divided in reſpect to its qualities, into vitrifiable and unvitrifiable; one that will melt by fire and become glaſs, and the other that will remain unaltered, ſuch as ſands, which are likewiſe called abſorbents, from their quality of imbibing liquids.

FIRE.

This element is diviſible into that which is concluded to originate from the ſun, and that which is called phlogiſton, as being univerſally held a conſtituent part of any body: that coming from the ſun may be called a fluid ſubſtance uninterruptedly flowing from him, and diffuſing itſelf through the whole planetary ſyſtem, and every particle of matter in it, but not as a native principle; hence it may be ſuppoſed the air itſelf would become a ſolid maſs without this intervening and active principle; its rarefaction and condenſation, with the dilatation of water, and ſimilar effects produced in the earth originating from it; and in all our operations it is the moſt powerful agent, and when collected in the focus of a large lens, is at the greateſt poſſible height producible by human art.

What is underſtood by phlogiſton ſeems to be different, being apparently fixed to all bodies, ſo as to make a part of them; but how ſo active, or, as it were, ſo reſtleſs a ſubſtance can be ſo fixed, is not yet determinable, as it differs from elementary or pure fire (juſt ſpoken of) in communicating neither light nor heat when joined to any other ſubſtance, and produces no change in its ſtate; ſo that a ſolid body becomes not fluid, nor a fluid ſolid, by its abſence. The ſign of any ſubſtance containing phlogiſton, is its being capable of taking fire; but, as in the caſe with metals which abound with it, and which are not inflammable, it is not thence inferred they have none. Thus a body may be ſaid to contain its phlogiſton, when after a flame ſubſides it ſparkles or waſtes, till reduced to a coal; and, adverting to the ſubject of colours, it is known, that the number which we perceive is owing to the varied combination of phlogiſton, with oils, earths, and ſalts.

The next general conſideration is, that of ſecondary principles,(11) which are conſtituted chiefly of ſaline and oily parts; and as all the experiments that have been made, prove there is ſuch a mutual agreement, connection, or dependance on one part with another, the knowledge of what ſubſtances thus agree or diſagree, under their various combinations, forms (as muſt be clear to every one, and which has been repeatedly enforced) the foundation of ſome certainty in making experiments for any purpoſe whatever; but before that can be known, in reſpect to particular ſubſtances, the nature of this univerſal affection ſhould be conceived, and likewiſe what are the affinities of the different claſſes of ſubſtances which comprehend the ſpecies belonging to them; therefore the following poſtulata or propoſitions received as fundamental truths, (ſimilar to axioms in mathematicks, or maxims in common life;) and the table or ſcheme of affinities which will afterwards follow, have been formed for that purpoſe.

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(11) So deemed as containing an analyzation of ſubſtances more ſimple than what they help to form, and are yet compoſed of primary principles.

I. Any ſubſtance having a conformity with another, the two will unite and form one compound.

2. All ſimple ſubſtances have affinity with each other, and will conſequently unite; ſuch as water with water, fire with fire, &c.

3. Subſtances when united together loſe ſome of their reſpective properties, and the compounds reſulting from their union partake of the properties of thoſe ſubſtances which ſerved as their principles.

4. The ſimpler ſubſtances are, their affinities are more perceptible; hence it is moſt difficult to analyſe bodies that are the leaſt compounded.

5. If to a compound, conſiſting of two ſubſtances, a third be added that has no affinity with one, but has a greater with the other, than the firſt 2 combined have with each other, a new decompounding, and a new union muſt enſue.(11)

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(11) Thus if you pour vitriolic acid on common ſalt, the mineral alkali having a greater attraction for the vitriolic acid than for the marine; leaves

6. A third ſubſtance offered to a body conſiſting of two, no decompoſition may follow; but the two uniting with the third, without quitting each other, may form a union of three principles; preſuming the third ſubſtance has an affinity, or nearly equally ſo with each of the other ſubſtances.(13)

7. Though a compound conſiſting of two ſubſtances, having a greater affinity with each other than with a body preſented to them, may not be decompoſed by it; yet that body, when combined with another, having an affinity with

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leaves the latter and unites with the former. The vitriolic acid is alſo ſaid to have a ſtronger attraction for the mineral alkali than the marine acid has: hence the former acid is ſaid to expel the latter from its baſis; or it may be ſaid demonſtratively thus; If A being united with C, upon B's being afterwards applied to them, lets go C and joins B, A is ſaid to poſſeſs a greater attraction for B than C.

(13) Thus when pure calcareous earth (lime) is diſſolved in the nitrous acid (aqua fortis), a cauſtic volatile alkali will not diſunite them, becauſe the attraction of the alkali with the acid is not ſo ſtrong as that of the calcareous earth.

with it, compenſating for its want of it with the others, may ſeparate the two, by uniting with each of them; therefore in this caſe there is a double affinity, a double decompoſition, and a double combination. (14)

What next follows is a table of affinities, or elective attractions, of one ſubſtance to another, or a more ſpecific repreſentation of the ſubſtances juſt alluded to, in the relation they are obſerved to have with other as productive of thoſe appearances that enſue by their operation on or with each other; the ſubſtances in each column or diviſion are placed in the order they agree with that at the top: thus in the firſt diviſion, Vitriolic Acid ſtands at the top; accordingly the ſubſtance that has the neareſt affinity to it is

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(14) Thus, to pure calcareous earth diſſolved in nitrous acid, (as above) let ærial or vitriolic acid be added, and the effect is obtained; the ærial acid acting on the earth on one hand, while the alkali acting on the nitrous acid on the other, diminiſhes the coheſion of the earth with the nitrous acid to ſuch a degree, that the volatile alkali is now able to unite itſelf with the latter acid, and expel the earth.

Phlogiſton; Fixed Alkali has leſs than Phlogiſton; Calc. Earth leſs than Fixed Alkali, and ſo on. (15)

Vitriolic Acid.	*Nitrous Acid.*
Phlogiſton	Phlogiſton
Fixed Alkali	Fixed Alkali
Calcareous Earth	Calcareous Earth
Zinc	Zinc
Iron	Iron
Tin	Lead
Copper	Tin
Quickſilver	Copper
Silver	Quickſilver
Volatile Alkali	Silver
Magneſia	Volatile Alkali
Earth of Allum	

Marine

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(14) It may be intimated, that all Chymiſts do not agree in the juſtneſs of theſe affinities in particular caſes, for in this inſtance (as well as in the inſtance of printing, and indeed in all human ſciences) circumſtantial differences will ever happen, ſince the perceptions of hardly two perſons are affected alike.

Marine Acid.

Fixed Alkali
Calcareous Earth
Zinc
Iron
Lead
Tin
Copper
Reg. of Antimony
Quickſilver
Spirits of Wine
Volatile Oils
Gold

Sulphur.

Fixed Alkali
Calcareous Earth
Iron
Neckel
Copper
Lead
Tin
Silver
Reg. of Ant.
Quickſilver
Arſenic

Liver of Sulphur is partially decompoſed by

Quickſilver
Solution of Fix. Alk.
Lime Water
Vol. Alk.

Fixed Air.

Calc. Earth
Fix. Alk.
Magneſia
Vol. Alk.

Alkaline Salts.

Vitriolic Acid
Nitrous Acid
Marine Acid
Acetous Acid
Vol. Vitriolic Acid
Sedative Salt
Fixed Air
Sulphur
Expreſſed Oils

Calcareous Earth.
Vitriolic Acid
Nitrous Acid
Marine Acid
Acid of Tartar
Acetous Acid
Sulphureous Acid and ſedative ſalt
Sulphur

Metallic Subſtances, Lead, and Reg. of Ant. excepted.
Marine Acid
Vitriolic Acid
Nitrous Acid
Sulphur and
Acetous Acid

Lead.
Vit. Acid
Mar. Acid
Nit. Acid
Acet. Acid
Expreſſed Oils

Reg. of Ant.
Vit. Acid
Nit. Acid
Mar. Acid
Acet. Acid

Arſenic.
Zinc
Iron
Copper
Tin
Lead
Silver
Gold

Reg. of Antimony (with Metals.)
Iron
Copper
Tin
Lead
Silver
Gold

Quickſilver.
Gold
Lead and Tin
Copper
Zinc, Biſmuth, and Reg. of Ant.

Silver.
Lead
Copper
Iron

Water.
Fix. Alk.

Spirits of Wine
Mild Alk. Salt and ſome Neutrals

Spirit of Wine.
Water
Oils and Reſins

In conſequence of heat, ſedative ſalt decompoſe tartar and ſea-ſalt, phoſphorus acids decompoſe vitriolated tartar, nitre and ſea-ſalt.

Inſtances of double elective attractions.

As where the two compounds being mixed, thoſe oppoſite to each other, as they are here exhibited, unite and form double affinities.

Acids. - -	Vol. Alk.
Calcareous Earths, or Metallic Subſtances.	Fixed Air
Vitriolic or Marine Acid.	Mercury, Silver, or Lead.
Alk. or Earth.	Nit. or Mar. Acid
Lead. - - -	Vit. Acid
Nit. Mar. or acet. Acid	Alk. Earths or Metallic Subſtances

Silver - Vit. Mar. or acet. Acid.	Fixed Air Fixed Alk.
Nit. Mar. or acet. Acids. Calc. Earth. -	Vol. Alk. Magneſia, or Earth of Allum Vit. Acid

Inſtances in Diſtillations and Sublimations, and that require heat.

Vol. Alk. - Acids. - -	Fixed Air Calc. Earth
Vol. Alk. - - Vit. Acid. -	Nit. Mar. or acet. Acid. Fix. Alk.
Vol. Alk. - Nit. Mar. or Vit. Acid.	Acet. Acid. Fix. Alk. or abſorbent Earths.
Reg. of Ant. Sulphur -	Mar. Acid. Quickſilver

Inſtances in Mixtures by Fuſion.

Tin - - Silver -	Iron Lead
Copper - Gold - -	Sulphur Lead

Metallic Subſtances	Sulphur
Gold - -	Reg. of Antimony

The affinities or attractions here diſplayed are either in the humid or dry way; the humid is, when one, at leaſt, of the ſubſtances is fluid in the heat of air, or a heat but little beyond; the other is, when to produce a fluidity, the application of burning fuel is neceſſary.

Example in an inſtance of ſingle attraction.

Apply to cinnabar and iron filings, a certain heat; the mercury of the cinnabar will riſe, and leave the brimſtone, its other element, combined with the iron, which it attracts in preference to the mercury.

Example in an inſtance of double attraction.

Unite mercury with common ſalt, by means of a like certain degree of heat, a new compounded combination will commence among the ſubſtances: by the marine acid of the common ſalt joining the quickſilver of the mercurial ſalt, forming a new ſalt called corroſive ſublimate, while the mineral alkali of the common ſalt unites with the vitriolic acid of the firſt mercurial ſalt, and forms what is called Glauber's ſalt.

Of Salts in General,

or Saline Subſtances,

compriſing Acids, Alkalies and Neutrals.

SALINE ſubſtances are combinations of earths and water, or they are combinations capable of uniting with either of them, or with both together, for all ſalts are reſolvable into earth and water, and the more or leſs they are united to their earths, they are fixed or volatile, which circumſtance makes the difference between acids and alkalies. Acids are the ſimpleſt of ſalts, uniting readily with water, are ſharp to the taſte, and have the diſtinguiſhing property of turning vegetable blues and violets red.

Alkalies have a greater proportion of earth than acids have, and have leſs affinity with water, but unite violently with acids, producing an efferveſcence and hiſſing; they are fiery and acrid to the taſte, and turn vegetable blues and violets green.

Neutral Salts are formed from the union of an acid and alkali, by which union they rob each other of its properties, which are then ſo blended that neither predominates, and which intimate union is called the point of ſaturation: they produce no change in the blue colours of vegetables, and are neither acrid or ſour, but ſalt, ſuch as is the taſte of kitchen ſalt, and are generally known by the plain general term of ſalts. Imperfect neutrals are thoſe in which either the acid or alkali predominate.

Of the univerſal or vitriolic Nitrous and Marine Acids.

The univerſal acid, according to its name, is found diffuſed in the waters, in the atmoſphere, and in the bowels of the earth, but ſeldom pure or unmixed with other ſubſtances; what the greateſt quantity is collected from is vitriol, hence it is called the vitriolic acid; and when it contains only juſt phlegm enough to give it a fluid form, it is called oil of vitriol; if it contain much water, it is called ſpirit of vitriol; when it has not enough to render it fluid, it is called the icy oil of vitriol.

This acid combined with a certain abſorbent earth, with the nature of which we are unacquainted, forms a neutral ſalt called allum; differing in quality according to the earths with which the vitriol is combined: An alkali being preſented to allum, the acid will quit the earth and join the alkali, and from the junction of the vitriolic acid, with a fixt alkali, a neutral ſalt is formed, called either *arcanum duplicatum*, or *vitriolated tartar*, one of the fixed alkalies moſt in uſe, being ſalt of tartar.—See Maddering, and note 27.

The conjunction of this acid with phlogiſton forms ſulphur.

Nitrous Acid.

This is no other than the vitriolic acid combined with phlogiſton, by the agency of putrefaction, at leaſt ſuch is the received opinion, the nitrous acid being found only in earths and ſtones, impregnated with matters ſubject to putrefaction; when combined with chalk, ſtone, marble, &c. it forms a ſalt, that does not chryſtalize, which runs in the air, per deliquium, and is decompoſed by fixed alkalies, with which the acid unites and quits the earths, and from this union reſults *ſalt-petre.*

The moſt remarkable and diſtinguiſhing property of nitre is its diſpoſition to unite with phlogiſton, in its pureſt ſtate, ſuch as char-coal, ſulphur and metallic ſubſtances; thence burſting into a flame with great noiſe, called its detonation or deflagration, in which caſe the acid is diſſipated, and the alkali which is left is called fixed alkali.

A nitre is to be procured by dropping into ſpring water, a ſolution of fixed alkaline ſalt, filtrating the liquid and evaporating it to a certain degree.

Marine Acid or Sea-Salt.

In reſpect to the conſtituent parts of this acid, wherein it differs from the vitriolic and nitrous, it is not certainly known, no more than it is wherein they differ from each other; but when combined with abſorbent earth (lime or chalk) it forms a neutral ſalt, that does not chriſtalize, and when dried, attracts the moiſture of the air: This acid, like the others, has leſs affinity with earths than with fixed alkalies, but as well as the others have, it has a greater with phlogiſton; and when combined with fixed alkali it forms a neutral ſalt which ſhoots into cubical chryſtals, and is inclined to run in the air.

The acid of this ſalt when freed from its baſis, is called *ſpirit of ſalt*, and when containing little phlogiſton, it is called the ſmoaking ſpirit of ſalt, from its then continually emitting vapours.

Combined with phlogiſton, a kind of ſulphur is the reſult, that takes fire on being expoſed to the air, called *phoſphorus of urine*, being generally prepared from urine.

India ſupplies us with another acid called borax, which flows and takes the form of glaſs, and poſſeſſes ſome of the properties of fixed alkali.

LIME.

Any ſubſtance that has been roaſted in a ſtrong fire without melting, is called a calx; ſtones, (which are ſubſtances compoſed of different earths) reduced to this ſtate is called lime; this applied to fixed alkalies make them more active and renders them corroſive or cauſtic, and from which the common cauſtic ſtone is prepared: Lime unites with all acids, and chryſtalizes with the marme, but not with the nitrous.

Quick lime attracts the air like concentrated acid, and dry fixed alkali, but not ſo as to render it fluid; it only takes the form of a powder, and is then called ſlacked lime; when once ſlacked, though it ſeem ever ſo dry afterwards, it requires a violent calcination to ſeparate the water from it, which it had imbibed. Sand is mixed with it in making mortar, or it would otherwiſe contract and conſequently crack and break.

In Chemiſtry it is deemed holding a middle rank between abſorbent earths and fixed alkalies.

Metallic Subſtances.

Theſe conſiſt chiefly of a vitrifiable earth combined with phlogiſton, and are therein fuſible; they are likewiſe ponderous, opaque, and ſparkling: a third principle is contended for by ſome chymiſts, called mercurial earth, but it is doubted to exiſt by others.

Metallic ſubſtances readily unite with moſt acids, and in that caſe an ebullition with vapours ariſe; by degrees the metallic particles become inviſible in their ſolvents, and the metal is then ſaid to be diſſolved; but, as with alkalies, an acid can only take up ſuch a portion as is ſufficient to deſtroy ſome of its properties, and to render others weaker. The affinity that metallic ſubſtances have with acids, is leſs than what they have with abſorbent earths and fixed alkalies, ſo that the acid which will unite with theſe ſubſtances, will decompound the metalline ſalts, and precipitate the metal, which are then called precipitates and mageſteries.

Metallic ſubſtances are 6 in number, 2 perfect viz. Gold (Sol) Silver (Luna) and 4 imperfect, viz. Copper (Venus) Iron (Mars) Tin (Jupiter) and Lead (Saturn ;) Quickſilver (Mercury) is by ſome, called a ſeventh metal.

GOLD.

As metals are the heavieſt ſubſtances known, gold is the heavieſt of all, and when pure, is unalterable in fire as far as any experiment hath hitherto proved, neither can it be diſſolved by any pure acid ; but only by the acid of nitre mixed with that of ſea-ſalt, called aqua regia. Gold is likewiſe the moſt ductile and moſt malleable of all metals.

A remarkable circumſtance, and as yet not clearly accounted for, is the fulminating quality of the precipitate by an alkali or abſorbent earth, gently dried and expoſed to a certain degree of heat ;

heat; this is called *aurum fulminans*, but the acid of vitriol poured on it, will deprive it of that quality, as will likewiſe be the caſe, if it be cleared of its ſaline particles, which, waſhing it in water will accompliſh.

Gold is not affected by a pure ſulphur when combined with an alkali.

SILVER.

This metal is the next perfect to gold, being lighter and leſs ductile, but like gold it reſiſts the greateſt force of fire, in which is their ſuperiority over all metals: The true ſolvent of ſilver is the nitrous acid, the chryſtals formed thereby are particularly cauſtic; it is likewiſe ſoluble by the vitriolic acid, if it be concentrated, but ſpirit of ſalt, and aqua regia, as well as the other acids, are not capable of affecting it: yet in reality it has a greater affinity with both, than with the vitriolic; for if the vitriolic or marine acid be added to a ſolution of ſilver in the nitrous, the ſilver will directly join it, and the precipitate procured by the marine acid, is called *Luna Cornea*: Fixed alkalies and abſorbent earths will ſeparate the ſilver from the nitrous acid, though the nitrous acid cannot act on it when mixed with an equal quantity of gold, but when in a triple proportion it can with eaſe: If aqua regia be employed when they are in equal quantities the ſeparation will be effected, by the gold being diſſolved and the ſilver left free; but the operation by aqua fortis is to be preferred, it having no effect on gold, and a little of the ſilver is always taken up by the aqua regia: Silver united with ſulphur ſoon flows, and forms a mallable maſs, the colour of lead:---Solution of ſilver in the nitrous acid ſtains hair, bones, wood, &c. from a brown to a black, and gives a ſtain to marble and other ſtones.

COPPER.

This is the firſt of the imperfect metals, it reſiſts fire a long time, unites readily with gold and ſilver, and is ſoluble in all the acids, neutral ſalts, and even in water; to ſome imparting a green colour, and to others a blue: diſſolved in vitriolic acid it forms blue cryſtals, called blue vitriol or vitriol of copper: diſſolved in aqua regia, the marine or nitrous acid, it forms a ſalt which does not cryſtalize, and runs in the air: The precipitates by alkalies or earths retain nearly the colour the ſolution gives: mingled with nitre and expoſed to the fire, as well as the other imperfect and ſemi-metals, it is ſooner decompoſed and calcined than if preſented alone: mixed with ſulphur and made red hot, it ſoon melts and forms a new compound more fuſible than alone.

IRON.

This metal ſtands alone for its property of being attracted by the magnet, but loſes it if reduced to a calx, or converted to an earth: by repeated melting it is rendered purer than by having only undergone fuſion, but is not malleable till after being heated red and hammered in all directions: before this proceſs it is called *pig-iron* but *bar-iron* afterwards; and is then harder to fuſe: Fuſing it with articles that contain phlogiſton, or encloſing it in phlogiſton matters, and expoſing it thus in juſt a red hot ſtate for a certain time, it is converted into ſteel or hardened: Suddenly quenching it when red-hot in a cold liquor, the hardneſs is augmented, and that in proportion to the heat of the metal and coldneſs of the water; it may be brought back by cementing it with calcined bones, chalk, &c. rendering it red hot and leaving it to cool gradually, or if heated alone, and left thus to cool, the temper given to ſteel is deſtroyed. Iron being calcined turns to a yellowiſh cruſt, by loſing its phlogiſton, and is then called *crocus martis* or *ſaffron of mars.* All acids, as well as certain ſalts, alkalies, and water itſelf, operate on it, but the vitriolic acid diſſolves it the readieſt, rendering the ſolution of a beautiful green; the cryſtals produced by which are called *green vitriol, vitriol of mars*, or *copperas*: Ochre is the ſediment produced from green vitriol diſſolved in water:- Spirit of nitre diſſolves iron with eaſe, producing a browniſh yellow, but the calx formed by this ſolution cannot be a ſecond time diſſolved, for having loſt its phlogiſton, the nitre will not act on it, neither does this nitrous ſolution cryſtallize: The ſolution by ſpirit of ſalt is green, the vapours of which are inflammable, as well as thoſe cauſed by the vitriolic acid: the ſolution in aqua regia is yellow.

Iron having a greater affinity with ſpirits of nitre and ſpirits of vitriol, than either ſilver or copper has, if offered to a ſolution of either, the ſilver or copper will precipitate, by the acid quitting them and joining the iron: Iron filings expoſed to the dew, turn entirely to a ruſt, called *crocus martis aperiens:* united with ſulphur, it acquires a great degree of fuſibility: Iron makes a part of almoſt all ſubſtances (which the magnet will diſcover) it is found in the caput mortuum of all vegetable ſubſtances, even in honey, the earth being ſuppoſed to be impregnated with a ferruginous or vitriolic matter, and from thence received into vegetables, and from vegetables it paſſes into animals: It is the only metal that ſparkles in the focus of a burning glaſs.

TIN.

This is the lighteſt of all metals, has but little ductility and runs long before it is red hot: The calx when vitrified, being mixed with ſome other ſubſtance is called enamel, which is differently coloured by means of other metalline calces: Tin unites with all metals, but deſtroys their ductility and malleableneſs, lead excepted: Thoſe the moſt ductile it effects the ſooneſt, and in the greateſt degree: Bronze and bell-metal are made from a compoſition of this metal with zinc: mixed with lead it produces pewter, and is uſed with quick-ſilver in making looking-glaſſes.

The vitriolic, nitrous and marine acids have an affinity with it, but cannot eaſily diſſolve it, as they only reduce it to a kind of calx: The proper ſolvent (as mentioned more fully further on) is aqua regia, and has even a greater affinity with it than with gold. Gold precipitated by this method is a moſt beautiful colour, and uſed as a red for porcelain and enamelling: It has the property of giving red colours in general, hence tin veſſels are uſed in making fine ſyrup of violet. It is not affected by water as iron and copper are, but it loſes its poliſh on exposure to the air: It readily unites with ſulphur.

LEAD.

This is the heavieſt of all metals, gold and ſilver excepted, is ſofter than any, and except tin, melts the eaſieſt: Vitriolic acid affects it nearly as it does ſilver; the nitrous acid diſſolves it with much eaſe, and in great quantities; the cryſtals are of a ſweet taſte, of a yellowiſh colour, and are not eaſily diſſolved in water: Spirit of ſalt, or the ſalt in ſubſtance, added to the ſolution in nitrous acid, produces a white precipitate called *plumbum cornea*, which diſſolves eaſily in water : Being melted, it hardens into a kind of horny ſubſtance, like the luna cornea (whence the name:) Lead boiled a long time in a lixivium of fixed alkali will partially diſſolve : It is rendered very refractory by ſulphur.

QUICKSILVER.

This ſubſtance is ſoluble in acids, but to each acid, particular circumſtances are annexed ; thus the vitriolic acid concentrated and made boiling hot, reduces it apparently to a white powder ; which on the affuſion of water turns yellow and is called *turbith mineral.*

Quickſilver is eaſily diſſolved by the nitrous acid ; the ſolution is clear, and as it cools ſhoots into cryſtals : If evaporated to dryneſs, it produces red precipitate : With ſolution of copper the precipitate is green.

Combined with marine acid, it forms a metalline ſalt, the cryſtals of which, called *corroſive ſublimate*, are pointed like daggers, and is the moſt violent corroſive hitherto diſcovered : From this ſublimate is produced yellow precipitate : Quickſilver unites with ſulphur very eaſily, and produces by the mere mixture, *ethiops mineral* :

neral: By rendering the union more perfect by a ſtrong heat, a ponderous ſubſtance is procured called *cinnabar*, which finely ground produces *vermillion*.

Of Semi - Metals,

Namely, Regulus of Antimony, Biſmuth, Zinc, Regulus of Arſenic.

Reg. of antimony has the brilliancy, opacity, and gravity of a metal, but like all ſemi-metals, crumbles under the hammer: It ſoon diſſipates into ſmoak and white vapours by a violent heat; flowers of antimony are thoſe vapours, collected by any cold body, which ſtops them in their aſcenſion.

Its affinity is greateſt with iron, copper next, and then with tin, lead, and ſilver.

Its proper ſolvent is aqua regia, marine acid next, if highly concentrated and applied by diſtillation; The vitriolic acid likewiſe diſſolves it, but with the nitrous it is little more than calcined.

Liver of antimony is procured by mixing nitre with it, three parts nitre and one of antimony produces a calx called diaphoretic antimony, or diaphoretic mineral. Antimony is uſed to ſeparate gold from other metals, and the precipitate from its union with an alkali, is called the *golden ſulphur of antimony.*

BISMUTH.

This ſubſtance is rather duſkier than the former, and like other ſemi-metals is volatized with a violent heat: It mixes with and quickens the fuſion of all metals, whitens them, and deſtroys their malleability.

Biſmith is not ſoluble in the vitriolic acid, but in the nitrous it diſſolves with much fume: Marine and aqua regia diſſolve it, but with leſs rapidity; alkalies, and even water only, precipitate it, forming the *magiſtery of biſmuth.*. In its union with ſulphur it forms a compound, appearing like needles lying ſideways by each other.

ZINC.

Zinc differs little in appearance from biſmuth, except having a bluiſh caſt, though eſſentially it differs very much: It melts the moment it grows red, ſoon turning to a calx; and in an augmented heat burns like an oily matter, evincing the great quantity of phlogiſton which it contains.

It unites with all metallic ſubſtances except Biſmuth; It is ſoluble in all the acids, particularly in the nitrous; ſulphur has little or no power over it.

It has a greater affinity with the vitriolic acid than iron or copper has, forming a precipitate called white vitriol, or vitriol of zinc: United with copper it makes braſs, pinchbeck, &c.

REGULUS of ARSENIC.

This readily unites with all metals, and is the moſt volatile of the ſemi-metals, flying off even by a moderate heat: the calx is plain arſenic; the properties of which are peculiar to itſelf, having great volatility, having a ſaline character, being ſoluble in water, and exceſſively corroſive, a quality none of the other ſemi-metals poſſeſs: It cannot be decompounded by any acid, except when joined to metallic ſubſtances; Combined with the alkali of nitre or ſea-ſalt, if they be in a fluid ſtate, it forms a ſingular ſaline compound, called *liver of arſenic*; Arſenic unites readily with ſulphur, and produces *yellow orpiment.*

Inflammable Subſtances.

These are Sulphurs, Oils, Reſins, Bitumens, Spirits of Wine, Charcoal.

ALL bodies probably contain more or leſs phlogiſton, but theſe are deemed inflammable in which it abounds, but with which, at the ſame time, it is not ſo intimately blended, but that it may be driven out from them, under certain circumſtances, by the intervention or ruſhing in of the air.

Sulphur (as ſaid before) is the vitriolic acid combined with much phlogiſton. Oils are mineral, vegetable, or animal, and are, in general, unctuous bodies, that burn and conſume with flame and ſmoke, containing phlogiſton; which by means of an acid is united with phlegm or water, together with a certain portion of earth: Nitrous and vitriolic acid, act on oils according to the portion of phlegm which they contain.

Charcoal, or any charred matter, is what is left from the burning of any vegetable or animal matter, that has an oil united to much earth; this ſubſtance is unalterable by any other body than fire; hence acids ever ſo highly concentrated have no effect on it.

Reſins will be ſpoken of in the next ſection.

Of Vegetable Subſtances.

From the analyſis of vegetable ſubſtances, it is clear they contain phlegm, an acid, a light oil, much air, and a thick oil, but none of theſe principles can be obtained pure by mere diſtillation, as their ſeparation is only began by this proceſs, therefore others are adopted to compleat the analyſis.

Some vegetables, by analization, prove that they contain the ſame principles as animal ſubſtances poſſeſs, and inſtead of yielding an acid, a volatile alkaline only is to be obtained; probably becauſe the acid of the vegetable ſuffers ſuch changes when it enters into the compoſition of animals, that is, it combines with ſome of their earth and oil, in ſuch a manner as to be changed into a volatile alkali.

In burning any vegetable ſubſtance in the open air, the analyſis is more rapid and compleat, burning till all its oil is conſumed, and a coal remains, and this continues waſting till all its phlogiſton is diſſipated, what then is left is its earth and fixed alkali, commonly called the aſhes. Water, the natural ſolvent of ſalts, takes all of them up that are contained in the aſhes, ſo that by lixiviating them, nothing at laſt is left but the pure earth.

All balſams, as well as turpentine, are oily aromatic matters, procured by different methods from thoſe trees which produce them; theſe abound with eſſential oils ſeparated from the vegetable in which they exiſt.

Reſins are diſtinguiſhed from natural balſams by containing leſs oil, and more acid, ſo that they are leſs diſpoſed to be fluid, and are ſoluble only in ſpirits of wine; they however differ from each other according to the quantity or quality of acid to which they owe their conſiſtence: The ſaline character of Benjamin is evident from its being ſoluble in water, but then it muſt be boiling; the ſalt produced from it will chryſtallize and may be diſſolved in ſpirits of wine.

Gums differ from reſins in being ſoluble in water, but (as before ſaid) reſins are not; reſin being an eſſential oil grown thick, and have an aromatic odour, which gums have not: the ſmall portion of oil which gums contain, being ſo thoroughly mixed with their acid, does not hinder their diſſolving in water, and therefore they reſemble honey, and other vegetable juices, in being originally fluid, and only grown hard by the evaporation of their moiſture ; the ſame as reſins become ſolid by loſing, in the ſame manner, their fluid parts : but in gum-reſins, the two qualities are ſo blended, that each will diſſolve in its proper menſtruum, leaving the other entire.

Sugar, manna, and all the ſaccharine juices of fruits and plants, are of the nature of honey, containing a phlegm, an acid, an oil, and a coal : but differ from reſins in not being inflammable, or will not flame till nearly reduced to a coal : All theſe ſubſtances are deemed natural ſoaps, conſiſting of an oil rendered miſſible with water by means of a ſaline ſubſtance, but differ from common or artificial ſoaps in having their ſaline part an acid, while that of the others is an alkali: Why they are ſweet, thongh containing much acid, is from the acid being intimately ſheathed or ſmoothed by the oil : Of ſoap it may further be ſaid, that alkalies or acids combined, in a certain manner with oil, produce them ; for oily and ſaline ſubſtances combined, follow the ſame rules as other combinations, by reciprocally combining the properties belonging to each other, and (according to the rules of affinities) ſoaps are decompoſed by alkalies, and alkalies by acids.

The moſt expeditious mode of making a ſoap (being Dr. Lewis's improvement on Mr. Beaume's) is, by heating the alkali red hot, then throwing it into oil of turpentine, and ſtirring them well together; in time, a ſalt-cryſtallizes both within it, and over its ſurface, but its nature is unknown.

Of Animal Subſtances.

Theſe produce jellies, which when inſpiſſated and become ſolid in the cold, form glue, and by the evaporation being carried further, it becomes horn.

This jelly, or gelatinous ſubſtance, is the only true animal one; as all human parts, bones and all, are to be reduced to it; the other properties it has in common with vegetables gums or mucilages, except that the animal one makes a ſtronger cement: Acid, and alkalies particularly, eaſily diſſolve animal jellies; but the nature of theſe combinations is not known.

Of Earths.

Earths are either ponderous; calcareous *(Lime)* magneſia; argillaceous *(Clay;)* or ſilicious *(Cryſtal)* They are characterized by remaining unaltered in a red heat, and of thoſe five above mentioned no one has been yet able to decompoſe or tranſunite one into another.

Ponderous earth forms with vitrolic acid, ponderous ſpar, and is not ſoluble in one thouſand times its own weight of boiling water.

Calcareous earth ſaturated with vitriolic acid forms *gypſum*, known by the property it has of forming, after a ſlight burning, a hard maſs with water.

Magneſia ſaturated with vitriolic acid, forms what is called *Epſom ſalt.*

Pure argillaceous earth with vitriolic acid forms an allum.

The above four kinds may be called abſorbent earths, but the laſt has the leaſt claim.

Silicious earth is not affected by vitriolic acid, it is however diſſolved by that of ſpar, the diamond excepted, neither is the diamond changed by the greateſt heat, if not expoſed to the air.

Of Fermentation and Putrefaction.

By fermentation is underſtood (as partly mentioned before, ſee notes 12 and 33 in copper work) be a ſpontaneous motion in a body, by which a new diſpoſition and combination of its parts is produced: To procure it there muſt be a certain proportion of watery, ſaline, oily and earthy parts, the ſubject muſt be in a temperate heat, and have the aſſiſtance of the air: And as all animal and vegetable ſubſtances contain the principles juſt mentioned, they are of courſe all ſubject to fermentation: Minerals are excluded, not being as far as can be diſcovered, ſubject to this operation.

There are three ſpecies of fermentation, the vinous or ſpirituous, or what produces wine, and ſpirituous liquors; the acetous or what produces acid liquors, ſuch as vinegar; and the putrid, or what generates an alkaline volatile ſalt.

The ſubjects of the ſpirituous are moſt fruits, ſeeds and grains, diluted with a certain quantity of water; by certain proceſſes, air bubbles ariſe with vapours, ſo extremely active and pernicious that without caution the effects may be fatal, this operation, if not ſtopped, will proceed to the laſt ſtage, namely putrefaction; the imparities then precipitate and leave the liquor clear and tranſparent.

By diſtillation an inflammable liquor light, pleaſant and penetrating is drawn from wine that has fermented, which by repeated proceſſes become more and more rectified, and is called ſpirit of wine; and if conſiderably purified, an ardent ſpirit; which burns without ſmoak or leaving any coal: united with acids they loſe their pungency, and are ſaid to be dulcified. This ardent ſpirit may, however, be rectified, or entirely dephlegmated till it produces æther, which is ſo volatile that it flies off in the air, fires at the approach of a flame, and leaves not the leaſt appearance of aſhes; diſſolving oily matters with the greateſt eaſe, and has a greater affinity with gold than even aqua regia has.

Beſides this ardent ſpirit, a deal of water, oil, earth, and a kind of acid is afforded by wine, which when the ſpirituous part is extracted ſuffers no farther change: but if they all remain, the fermentation, after ſome time, will begin again, the liquid turns ſour, and then acquires the name of *vinegar* ; but this produces no noxious vapours, nor depoſits any tartar: Wine however is not alone the ſubject of acetous fermentation, for ſeveral vegetable, and even animal ſubſtances, not ſubject to the ſpirituous, turn ſour before they putrefy: this acid has the ſame properties as the mineral, and has effect on the ſame ſubſtances that the mineral acid has, but in a weaker degree: It has a greater affinity with alkali than ſulphur has, and a neutral oily ſalt is formed from its ſaturation with a fixed alkali. By its ſolution in ſpirits of wine, is produced *regenerated tartar:* Several ſaline compounds are produced by its union with calcined pearls, corals, ſhells, &c. it perfectly diſſolves lead, converting it into a neutral metallic ſalt, from which is produced *Sal Saturni*, or *Sugar of Lead*, becauſe of its ſweet taſte; The vapour of vinegar has that effect on lead as to produce *ceruſs*: Vinegar likewiſe corrodes copper, and converts it into a green ruſt, called *verdigreas*, though not commonly employed for that purpoſe, wine, or the rape of wine, being more uſed.

Tartar is a ſaline compound, containing earth, oil, and a ſuper proportion of acid; it is formed in wine-caſks, adhering to the inner ſides, particularly in thoſe that contain acid wines; when purified, there appears on the ſurface a cryſtalline pellicle, or ſort of ſkin, which taken off is called *cream of tartar*, the cryſtallizations of the ſame liquor are called *cryſtals of tartar*, and only differ in form from the cream; and though they have the appearance of a neutral ſalt, yet they have all the properties of a true acid, but weaker than any other: by calcination a fixed alkali is procured from tartar, ſtronger and more ſaline than what is formed from moſt other matters.

The laſt ſtage of fermentation (though by ſome deemed a diſtinct operation(16) is putrefaction, to which ſtate when a body is approaching, it is evident by a ſuperior degree of heat, the effect of which, as in the preceding ſpirituous and acetous operations, tends to change the diſpoſition of the particles of the body in which it is excited; though how it is brought about, is not yet diſcovered; but after it has undergone the change, the body ſeems then to contain a principle

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16 **Boerhaave particularly, Stahl however denies it.**

principle that it did not before, a ſaline matter exceedingly volatile, and is, when ſeparated from the other principles of the body which produced it, either a volatile urinous ſpirit in a liquid form, or a volatile urinous ſalt in a maſs. In this ſtate, whatever difference there might have been, before in vegetable ſubſtances, none is now viſible.

End of the Compendium of Chemiſtry.

Note, It is in different places obſerved, that it would be abſurd to offer poſitive or ſpecific rules for the performance of the operations juſt treated of, and for which, various reaſons are given (ſee introduction to copper-work note 16, and other places) therefore according to the ſame principles the ſubject of this ſection will be treated in a ſimilar manner; and as the preceding part of this ſection was exhibited under an idea that a knowledge of chemiſtry ſhould be the foundation of the practice in its fulleſt extent, ſo the following compendium or general view of operative circumſtances is exhibited as the foundation of thoſe proceſſes which ariſe from them, ſpreading every way into an endleſs variety, and which can only be conceived by long experience in the practice of them.

Red,

1. Red, yellow, and blue, are the primitive or fundamental colours, and from which, under various combinations, all colours or ſhades that exiſt in nature that are to be procured. Black is excluded on a philoſophical conſideration.

2. Moſt colouring materials require ſome operation to ſeparate or diſſolve their tinging qualities; ſome will give no permanent colour, till the ſubject intended to be coloured is printed with ſome aſtringent, ſuch as allum, which will ſecure the particles of the colouring ſuch, ſuch as red from madder, yellow from woald, &c. or by the addition of others the colour is varied according to the quality of the additional ſalts, as tartar, &c. vary the ſhade or colour that the allum only would procure.

3. In general the effect of colouring materials produced by certain ſolutions, is different from their natural outward appearance.

4. No ſubſtance is yet diſcovered that of itſelf will make permanent green (17), conſequently all durable

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17 Thouſands of unſucceſsful attempts have been made to attain this point, but till the tinging blue and yellow ſubſtance can be ſo equallized in quality, or harmonized in union. it is granted it muſt remain undiſcovered.— See more on this matter further on.

durable ones are compounded; neither is there any black material in uſe, that, of itſelf, gives a permanent black.(18)

5. In ſome caſes, the colouring liquid muſt be boiling, in others luke-warm, and in others cold: ſome drugs require a certain age, and others not: the materials which form different veſſels, in which colours are made or kept, ſhould be conſidered, as well as their capacities, or the uſes to which they may have been before applied.

6. In the operation of faſt work, ſhould be conſidered 1. the opening of the body to be coloured: 2. the colouring matter itſelf, and 3. the fixing of it, to which may be added, the clearing or brightning of it.(19) See the end of copper-work.

Note, Cleanlineſs at all times, and in every ſtage, cannot be too much enforced; thus if the colour maker be ever ſo careful, his endeavours may be

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(18) It is remarkable in many caſes, that the deepneſs of the black depends on the height of the white of the ſubſtance from which it is produced, as ivory when burnt; and ſome materials, as madder, woad, and indigo, will turn black in their effuſions, by repetitions of their tinctures,—ſee note 28 farther on.

(19) This brightening is too much practiſed, not as here meant, but merely to fluſh up the colours, —See maddering, and note 39 of this ſection.

rendered abortive by the careleſs uſe of ſieves, pans, &c. A Colour-houſe ſhould never be open to every one ; and a place ſhould be ſet apart for delivering out colour : for wantonneſs and malevolence, it is well known, has in this caſe great latitude.

Drugs, and other Articles uſed in Colour-making. (20)

VEGETABLE Subſtances.

Gums arabic, ſenegal, tragacanth, maſtic, lac, copal, and dragons blood, Madder, Indigo, Woad, Weld, Sumach, Fuſtic, Saunders, Annotto, Greenwood, Logwood, Brazil, Safflower, Barks, Flower, Starch, Bran, French berries, Reſin, Aſh, Vinegar, Verjuice, Crude tartar, Galls, &c.

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(20) Non-colouring drugs, ſuch as allum, tartar, and other aſtringents, are thoſe which after being uſed, muſt undergo the proceſs of boiling with certain colouring drugs, ſuch as madder, weld, &c. &c.---This is a dyers term, and applied to articles uſed previous to colouring.

MINERAL Subſtances, Salts and Earths.

White and yellow copperas, Orpiment, Arſenic, Corroſive ſublimate, Roman vitriol, Vitriolic nitrous and marine acids, Salt-petre, Sal ammoniac, Verdigris, Tin, Pewter, Copper, Steel fileings, Antimony, Chalk, Tobacco pipe Clay, Lime, &c.

MISCELLANEOUS Subſtances.

Urine, Dung, Lamp-black, Acid of tar, Iron liquor, Hartſhorn, (21) &c. Other articles might be added, but the above are chiefly in uſe. ---See account of drugs, &c. further on.

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(21) The goodneſs of drugs is of the utmoſt concern, and well it is for thoſe Printers who are not under the neceſſity of being reſtrained in this reſpect ſome by choice will not have the beſt even when needed, and others for reaſons, too common in every ſtation of life, muſt take what materials they can get.

The moſt durable Black and Purples, are brought up in madder, by the agency of iron liquor: Reds by allum, and occaſionally tartar, ſalt of lead, and iron liquor, to vary the hue to a Pink, a Bloſſom, a Chocolate, &c. Yellows in weld, by allum and tartar: Olaves, Drabs, &c. by allum, tartar, and iron liquor: Doves, Browns, Greens &c. in Sumach, Fuſtick, Greenwood, &c. by allum, tartar, and iron liquor: Blue, from Indigo or woad, by the agency of aſh, lime, and orpiment.

Leſs permanent blacks, reds, purples, pearls, &c. are brought up in logwood, brazil, bark, &c. by the agency of iron liquor, galls, copperas, &c. but in ſkilful hands are to be much improved.

Chemical browns, buffs, pale greens, blue, ſalmon, and other colours, are by the agency of Tar acid, Iron liquor, Verdigris, Woad, Annotto, &c. brought up or ſtruck with lime, and other colours, ſuch as berry yellow, pencilled blue, procured from indigo, &c. require ſtreaming or rincing in water only.

Note, *As the above is only a ſummary, or elementary view of colours &c. a plan of a table for fixing proportions and ſhades to certain circumſtances, is offered further on.*

For conveying theſe mixtures to the cloth various articles are neceſſary to be uſed according to certain circumſtances; theſe vehicles are gums and paſtes (22); paſte being of a more compact conſiſtency than gum diluted, is uſed when lines or fine bodies or ſhades are required to be accurately expreſſed; diluted gum is more uſed in conveying ſolid bodies, in which no great accuracy of ſhape is required.

Of gums, tragacanth has ſeveral advantages, and if properly managed, would diſtribute as well as the arabic, but this article as well as the oak-gall is not always made the moſt of.

Lampblack (23), Brazil, &c. are neceſſary to deepen the colour of thoſe mixtures, which would otherwiſe be too pale for printing, in ſome caſes.

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(22) Paſtes are made from flour and ſtarch, and thoſe articles as well as gums ſhould be of the pureſt kind, when uſed as vehicles for carrying the colour.—Gums ſhould be tried that no ſaline quality has been incorporated with them by their having been before in a liquid ſtate by any accident, particularly at ſea.

(23) Lampblack is the leaſt innocent in general from its oily quality, it ſhould therefore be the lighteſt and blackeſt that can be had, which depends a great deal on its being well burnt, indeed it would often be the better for work if it were ſpared. Brazil is ſo innocent and the ſtain ſo eaſily removed, that little objection lays againſt it; it gives out its colour beſt with hard water.

Of Colour-making.

Attempting now to ſpeak immediately of the colour-makers practice, the firſt conſideration is in what degree of reſponſibility he ſtands, both as he has to act himſelf, and as he is concerned in the operation of others; which collectively conſidered, comprizes, 1. Aſhing, Souring, &c. or the preparation for the reception of his mixtures. 2. Printing or the application of them, and 3, ſtriking or fixing them, including rincing, ſtreaming &c. of chemical ones, or thoſe not brought up in the copper, (24) for though colour-making is a diſtinct proceſs from preparation, printing and boiling off, yet (as more fully conſidered further on,) being of the utmoſt conſequence to a colour maker how they are performed, he may be ſaid to be cloſely concerned in them.

The preparation has been ſpoken of, but for the ſake of preſerving a kind of formality in treating this part, what has been ſaid will 1ſt, be briefly recapitulated; 2dly, the nature and uſe of aſtringents will be next touched on; 3dly, ſome ſuggeſtions offered concerning colouring ſubſtances; including the reſult of various experiments; laſtly, the application of his mixtures in the operation of printing, with notes and obſervations on the whole, more or leſs applicable to the ſubject, as the diſcuſſion of it leads the writer (according to the unreſtrained mode in which he indulges himſelf) to deliver them.--- See introduction, and note 2 in copper work.

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(24) The fielding, may be ſaid, to be a proceſs which reſts with the foreman of the field, of which more is ſaid further on.

It is therefore firſt obſerved, that as goods appropriated for printing, though having undergone the proceſſes in uſe among whitſterers, or bleachers by profeſſion, may nevertheleſs contract in the courſe of their removal from one place to another, foulneſſes of various kinds: they are in general ſoaked or ſteeped in water, that any looſe dirt may be removed; but there may be foulneſſes which water only will not remove, of courſe ſomething more penetrating muſt be applied; if aſh be uſed, it is preſumed ſome unctuous ſubſtance is to be removed, which the aſh effects; but as the earth of the aſh is ſuppoſed to be left in the cloth, which water will not eaſily remove, an acid is to be applied for that purpoſe, or ſometimes to anſwer for aſhing, and the cloth thus (after the uſual proceſſes of planking, &c.) is rendered as pure and white as poſſible.

Here then commences the colour-makers immediate concern, and conſequently the conſiderations reſpecting it, of which, it need hardly be ſaid, the firſt is that of the nature or properties of thoſe ſubſtances that are requiſite to form a baſis for the colour, chiefly in reſpect to the relation they hold with each other in view of producing certain effects, according to the principles as eſtabliſhed by nature, which principles in the firſt caſe are applicable only to chemical experiments (as exhibited in the tables of affinities and the rules immediately preceding them) but in advancing a ſtep further, that knowledge muſt be conſidered as furniſhing us with means of turning thoſe experiments to advantage; therefore a colour maker when ſurrounded with his drugs &c. ſhould look upon every article as an inſtrument in his hands, that ought not to be employed in vain; but this knowledge, to its proper extent (ſo rarely to be met with) is not to be acquired merely from ſelf experience or the experience of others, and not only that ſuch ingredients mixed or applied in ſuch a manner will produce ſuch effects, but why and upon what principle it is eſtabliſhed, and by what laws it is governed: here is the ſpring that ſhould give motion to this department; here is the baſis on which the practice ſhould be erected and diffuſe itſelf; and here originates the grand ſource of a colour-maker's practice, namely, the knowledge of the laws of affinities, and the certain effects of combinations, previous to the adding of certain ſubſtances to each other: for in every mixture that can poſſibly be made, invariable effects according to thoſe rules will naturally follow.

Thus beginning with the principal articles in a colour-maker's province (ſee note 39 at the end of copper-work) namely, ſalts or aſtringents; (ſee note below) it is neceſſary to know, according to thoſe rules eſtabliſhed by nature, how each ſpecies affects any ſubſtance it may be offered to, and how it is affected in return; for all ſubſtances mixed with others of different qualities, muſt cauſe a change in ſome reſpect or other, according to the fundamental principles as exhibited in the beginning of the compendium of chemiſtry, (ſee rule 3) and this knowledge (it is again ſaid) is the proper foundation or ſupport of the practice of colour-making.

2d, *Of Articles that procure from various Subſtances their colouring Properties.* (25)

The articles of this deſcription are very numerous, and are the chief or only agents we are in poſſeſſion of, in procuring permanency of colour, and the moſt general in its application is allum; its ſuperior power is confeſt by its uniting two qualities, heightening colours, and fixing them at the ſame time. (26)

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(25) Theſe are chiefly allum, lime, marine ſalt, nitre, ſal-ammoniac, tartar, fixed and volatile alkalies, with various metallic ſalts, and are in general called aſtringents, though rather forced, as aſtringent is more applicable to medicine, and ſome articles have aſtringent and colouring qualities united, as galls, ſumach &c. but ſalts or acids would be too general terms; and technicals frequently want allowance in the uſe of them; thus, ſpecifically ſpeaking, lime is cauſtic; aſh, alkaline; tartar, acid; allum, ſaline; &c. hence, though not a practical term in printing, wherever aſtringent is uſed it alludes to ſtriking or fixing the colour.

Colours that are not permanent, are, it is apprehended, owing to the want of ſome ſuch ſubſtances being previouſly applied to the cloth, or of not being able to unite with them; hence (as has been ſaid) the colouring particles not finding pores ſufficiently open to imbibe them, are ſuppoſed to lay chiefly on the ſurface.

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(26) The manner of ſalts being applied in dyeing is different, according as the ſubject is wool, cotton, ſilk, velvet, thread, &c, their pores being different, in various reſpects, and conſequently their aptitude to receive colour is ſo likewiſe: thus ſome ſubſtances, as cochineal and kermes, that in dyeing give a ſcarlet to wool (which is the eaſieſt ſubſtance to colour) give a very dull one to ſilk and cotton, and require a larger quantity, ſee note 36 and 41. The remark is likewiſe applicable to the different manufacturing of goods; and it is mentioned in the beginning of Bleaching, that the preparation is neceſſarily different. This is intimated here to thoſe who think it is indifferent what ſubject any tingeing ſubſtance may be applied to, and may have occaſion to print an other articles than cotton or linen.

Lime has the property of uniting two of the greateſt oppoſites in nature, Salts and Earths; it is ſoluble in water, by means of fire; but the air renders it indiſſoluble again; thus it is capable of forming an unalterable cement when united with other matters; but allum, as above-ſaid, has a property beyond, which is that of attracting certain colouring particles (27): nitre, marine ſalt, ſal ammoniac, ſacrum ſaturni, and tartar, are, ſtrictly ſpeaking, only alterants, by changing the red to a crimſon, a bloſſom, a pink, &c. Neutral ſalts with a metallic baſis, rather give ſtrength to the colour, than ſolidity in reſpect to its fixity, for every colouring ſubſtance will vary its ſhade, according to the nature of the earth that attracts its particles:

Two neutrals, Copperas and Roman vitriol, with metallic baſes, are in common uſe, oweing to their aſtringent quality being in union with their alterative principle.

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(27) Roman allum being white, and pure, is the moſt proper, as roch allum contains iron.—See Pomet on drugs and the compendium of chemiſtry.

In procuring a black, it is in general by introducing within the pores of the cloth, particles of iron diſſolved in various liquids, and precipitating them on the ſubject by means of ſome aſtringent ſubſtance ſupplied with phlogiſton, ſufficient to render the iron black ; but this ſhould be done ſo that the precipitating matter do no injury, and that can only be accompliſhed in proportion as the particles are diſſolved.(28)

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(28) Iron, rather than cauſing a black, contributes to it from the effect of its attriction, as oak turns black by ſawing; white greaſe is made black by its friction with iron ; green fruit turns black if cut with a knife ; the black colour in earthen ware is owing to vitrified iron ; and copperas which is uſed in procuring a black, is the ſalt of pyrites, with which iron is incorporated.

The cauſe of rottenneſs, attributed generally to the copperas, uſed in procuring black, is owing to the earth of iron (where it is uſed) not being ſeparated from the ſolution, and when ſaid to be rotten from copperas, it is from the groſs particles not finding eaſy admiſſion into the pores ; hence they in a manner burſt open their encloſures, tearing of courſe, the parts that reſiſt.—See iron liquor further on.

It is to be underſtood (as before ſaid) there is no black ſubſtance, vegetable, animal, or mineral, that poſſeſſes the durable tingeing properties of indigo, madder or weld (theſe blue, red and yellow ſubſtances are mentioned, being moſt in uſe) for all black fœculencies are of too dry a nature to be introduced and fixed in any ſubject, either by any adheſive quality of their own, or by the previous uſe of aſtringents, as they only act on unctuous ſubſtances. (29) Galls, ſumach, logwood, &c. containing within them the primitive colours, blue, red, and yellow, it is thought a black is produced from a combination of them, and according as either is acted on by the ſalt of copperas or iron, and as made uſe of for procuring a black, it indicates by the ſhade that is left when the black is flown, on which the ſalt was employed. (30)

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(29) Here, according to the laws of affinities, (which ſhould always be borne in mind in whatever relates to colour-making) it is ſaid (though obſerved before, ſee article maddering) that between the aſtringent introduced to fix the colour, and the colouring ſubſtance itſelf, there muſt be a mutual attraction, or a greater one than between either of the ſubſtances and the liquid in which either may be ſuſpended, elſe they cannot unite ſo as to form that cement which cauſes permanency; hence (as before obſerved) there are no black ſubſtances that any ſaline aſtringent will take hold of, and even from their natural dryneſs, their particles keep at too great diſtance in water, ever to attract each other ſufficiently.—See note 31.

Of

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(30) Hellot and D'Apligny ſays there are many plants, which, treated like the anil (from which is procured indigo) would probably produce a black feculence, ſuch as the liquorice root, choak weed, and ſeveral others, as mentioned further on in ſpeaking of colouring ſubſtances; Dr. Lewis, however, doubts it.

The antient Gauls uſed myrtles in dyeing purple, and it is thought with the uſe of aſtringents a black might be raiſed with them, as well as from the barberry or prickly ſorrel; though ſome who have tried have not ſucceeded: Linnæus ſays, St. Chriſtopher's herb gives with allum a black, and Hellot ſays, a tree in the Brazils is of ſuch a black tingeing quality, as to dye the fleſh and bones of animals that eat it, black, ſimilar to the red effect of madder: the anacardium nut is ſaid to produce ſimply of itſelf a faſt black: but in caſes of this nature it is not much to be expected that perſons will go out of an old track,

and

3. *Of Articles containing* COLOURING *Properties.*

Various ſuppoſitions reſpecting the fixity of colours by the uſe of aſtringents have been mentioned, though (as intimated Note 29 in copper-work) the theory generally adopted is conteſted; and it may here be added, that Mr. Macquer likewiſe conteſts it, he however obſerves, that when the earth of allum, after being conveyed to the cloth, is moiſtened, it imbibes the colouring particles of the bodies it meets with, though the cauſe of the attraction is unknown (31), (ſee

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and if inclined to it, ſufficient quantities of ſuch articles are not to be procured till cultivated for ſuch purpoſes.—See note 42.

In general, infuſions of aſtringent vegetables mixed with green vitriol, produce black; rain water ~~catched in the open fields has a blueiſh caſt, but what~~ is catched from houſes grows purple, from ſome alkaline quality it thus receives.

(31) The acid of the allum is the vehicle for carrying the earth into the pores of the cloth: this ſubſtance, from being moiſtened, ſhews a diſpoſition to unite with the principle of inflammability, on which colours depend.

The principle of attraction conſiſts in 1, The aſtringent and the colouring ſubſtance) muſt be mutual (ſee note 28 on copper-work, and the article maddering, where what is here ſaid is alluded to) thus, according to the laws of affinities, the colouring particles would remain in the liquid in which they may be floating, ſuch as the particles of madder, but that the earth of allum has a greater affinity with them, from their unctuous qualities, than they have with the water: (32) in caſes where the earth of the allum does not attract the colouring particles, theſe particles may however have leſs affinity with water than thoſe which need this earth to fix them; hence though they enter the pores, yet, from their minuteneſs, they are not retained, nd from their ſoapy qualities are ſoon waſhed off; but the unctuous quality above ſpoken of, and the phlogiſton incorporated with it, is ſuppoſed by its union with

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mutual in their powers of attraction. 2. They muſt be at a diſtance proportioned to their powers of attraction. 3. This force muſt be ſuperior to that with which either is attracted by the fluid it is in.

(32) Acids having greater affinity with alkali than with earth, they leave the earth in form of a precipitate. See Rule 2, of the principles of combinations.

with the aſtringent to form that cement often ſpoken of, though with dry ſubſtances ſuch as zaffre, cinnabar, ochre, &c. it cannot be accompliſhed, however moiſtened the aſtringent may be, as the colouring particles would ſoon eſcape. (33)

Adverting to the doctrine of a vitriolated tartar (ſee introduction to maddering) Mr. Macquer obſerves he cannot ſuppoſe it perfectly ſtable(34) but the earth of allum or lime containing the phlogiſtic principles of colour, conſequently thoſe colours are produced, that are incapable of being deſtroyed except by acids; theſe phlogiſtic principles (as before obſerved) are earths, oils, and

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(33) It is a knowledge of this nature that callico-printers are requeſted to acquire, in order to aſcertain the quantity of madder, weld, &c. neceſſary to be uſed as mentioned in maddering.—See the article Maddering.

As lakes are cauſed by the combination of one ſubſtance with another, upon a principle ſimilar to what is above alluded, it will be here juſt obſerved as an example, that if a decoction of turmeric or madder, be made in a watery ſolution of fixed alkali and a proper quantity of ſolution of allum be added, the yellow or red particles will ſubſide; but at the ſame time the acid of the allum being abſorbed by the alkaline ſalts, the earth of the allum likewiſe ſubſides and dilutes and likewiſe brightens the colour, the cauſe of this operation is however allowed to be not fully known.

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(34) In callico-printing this ſeems to be the caſe, from the danger purple and ſometimes the reds are generally in, when in the weld copper, but this is moſt likely to be the caſe when tartar or ſaccharum is uſed, they being (as obſerved before) only alterants. It may however here be ſaid, that the ſame ſalts being again uſed, may in ſome degree join with thoſe that were uſed before, ſeparating them, as it were, from the other ſubſtance to which they are joined; or it may be ſaid (ſee below) that the yellow particles find admiſſion into pores, not filled by the red or purple, when opened by the hot water. Their ſolubility, as well as that of the allum before formed into a cement, by uniting with madder, &c. is oftentimes too evident when one colour is laid over another, even when ſtowed as much as poſſible, (in Printers' phraſeology the colour is ſaid to run) and this is particularly evident in heavy ground-work, and moſt ſo in black grounds, with large maſſes of purple.

Theoriſts do not ſeem clear in the caſe of and ſalts, from the quantity and quality of which all colours reſult, and the ſimple addition of any ſalt to any oily vegetable colouring ſubſtance will either vary or expel its colour, becauſe any ſalt ſimple or compound, deſtroying by the laws of affinity the combination ſubſiſting till then; the rays of light are differently refracted, therefore thoſe ſubſtances whoſe colour cannot be altered by any ſalt, are thoſe whoſe phlogiſton is perfectly combined with their other principles; Indeed if we perfectly knew the nature of theſe combinations, it would help us in making artificial compoſitions, by analyzing theſe permanently tingeing ſubſtances, but not knowing (as obſerved before) the manner in which theſe

principles

ſeveral colours, raiſed at once, or in ſucceſſion; as where purple is laid over red, blue over yellow, yellow over purple, or over purple and red, and ſo on; as here it can only ſeem that the ſalt firſt conveyed does not enter all the pores, but that it contracts ſome, and leaves others open, which in turn are entered by ſucceeding applications; ſome have thought that every pore would admit any number of colouring particles, one above another, and that as they ſucceeded each other, like blue over yellow making a green, different ſhades were accordingly formed.

principles are combined, as the utmoſt we can do, is only ſeparating them by decompoſing the colouring ſubſtances, we are under the neceſſity of endeavouring to improve on the known means with which nature has ſupplied us.

The juices of vegetables that will not give a faſt colour, are liquids combined with certain oils, and being eaſily converted into a kind of ſoap, by alkalies or neutral ſalts, are ſoon removed; for in this caſe (turning to the laws of affinities) the colouring particles are ſo intimately united with the fluid in which they are ſuſpended, that the earth of allum will give their dyes no ſtability. It is however thought poſſible that ſubſtances may be rendered permanent in their colouring properties, that naturally are not ſo, could abſorbent earths be introduced into their pores, (35) or by adding acids to the colouring juices, in order to decompoſe the ſoap, and facilitate the union of the aſtringent with the colouring ſubſtance; notwithſtanding ſuch decompoſition might produce a change in ſome reſpect with the colour. From animal juices colouring ſubſtances are rarely obtained; and could more be procured, it would be only going a further way about, as animal juices are derived from vegetable ſubſtances.

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(35) In Percival's Eſſays it is ſaid that logwood may be rendered faſt, by a preparation with fixed alkali.

As the merely ſimple juices or fluids of animals and vegetables, rarely furniſh materials for durable colours; and minerals, on account of their dryneſs are incapable of being attracted by aſtringents, we muſt ſeek thoſe ſubſtances whoſe principles form, or help to form that unctuous and phlogiſtic gluten or cement which is the cauſe of permanency; and of theſe the moſt able to impart their colour are, kermes, cochineal, gumlac(36), madder, weld, &c. being both gummous and reſinous, though in different degrees, or in other words poſſeſſing that phlogiſtic or inflammable property reſulting from the union of oils, ſalts, and earths, on the various combinations of which, colour (as repeatedly ſaid) depends, and which exhibit themſelves when attracted by the application of proper aſtringents. Brazil, logwood,

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(36) Theſe 3 belong more to dyeing, yet might nevertheleſs, be uſed in printing, but the price is againſt them:—Kermes was much uſed formerly by dyers, but cochineal is now ſubſtituted.

wood, fuſtic, &c. being particularly reſinous, their colouring ſubſtances are not ſo eaſily attracted by aſtringents, and the colour they give is therefore of leſs permanency.

Yellows are to be procured from moſt leaves, barks, and woods, that on chewing diſcover an aſtringent taſte, if treated in the ſame manner as weld; for the colours of moſt yellow flowers are durable, and are little affected by acids or alkalies, but other coloured flowers, as well as juices of plants, are rarely found to poſſeſs any permanently tingeing qualities, according to the experiments practiſed in common.

Reſpecting the general method of imparting permanent colour, the principle of the proceſs is but ſimple, (ſee note 39 in copper-work) ſaline ſubſtances being (as ſaid before) the chief means with which we are acquainted; thus, it may be obſerved, though a watery infuſion of madder and other articles, will impart a tinge, yet waſhing will eaſily remove it; but that is not the caſe if the cloth have a ſaline article previouſly applied to it; there is however an exception to this rule in indigo, which it is difficult to diſſolve (3) except by alkalies, oil of vitriol, orpiment, or combinations of orpiment with ſulphur. When diſſolved by alkalies, the colour is green, the colour naturally produced in vegetable blues by alkalies; but on expoſing cloth dipped in it to the air, it turns blue: other exceptions in vegetables are mentioned elſewhere, as likewiſe the received opinion why they are ſo.

Proceed-

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(37) The great ſolvent power of alkalies, by clearing away the ſordes, will help to bring the particles of indigo more in contact with the cloth: the cauſe why cloth, which when dyed by indigo, is green, turns blue when expoſed to the air, is thought to be owing to an attraction of the fixed air, by the alkali from the atmoſphere rendering the ſalt unable to diſſolve the indigo any further.—See Hellot on dyeing, but Dr. Lewis diſputes Hellot's theory; he ſays acids will affect the ſame appearance, and that with vol. alk. it ſhews no green. Hellot however, ſhews unleſs green appears it is not diſſolved, hence fixed alkalies are only proper.

In the ſolution of indigo by alkalies, lime encreaſes the diſſolving power, and if raiſins be thrown into the ſolution it throws up a copper-coloured ſcum, which gives a dye in a moment: Pruſſian blue digeſted in an alkali, will produce a blue if what is coloured with it, lays a little while in a weak ſolution of copperas, but very inferior to indigo in durability. Dr. Lewis gives a recipe for making blue colour, but few practitioners will approve of his proportions.

Proceeding further in the diſcuſſion o colouring qualities, it may be obſerved, as the fixity of colours produced by different ſubſtances being mixed together, is proportionate to the power of ſuch ſubſtances to withſtand the weather, it would ſeem as if there were ſome method to determine on their permanency, ſince it appears that the nitrous acid in general tends to heighten red colours, the vitriolic to crimſon them, the marine to dull them, and alkalies to deepen them, (38) for, in this caſe, the colour produced by the nitrous acid, can remain no longer, when expoſed to the air, than the ſpirit of nitre itſelf, becauſe the nitre being drawn into the air, the colour muſt fade; and the diſpoſition of colour to fade, muſt be in proportion to the permanency of the ſubſtances that produce them; colour, in this ſenſe, being only colour as it is in poſſeſſion of ſome ſubſtance to withold it; (39)
but

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(38) In drying plants between ſheets of paper, the paper is at laſt tinged with colour; this is ſuppoſed to be occaſioned by the allum uſed in making it—By rubbing a plant on blue paper, if acid, it turns the paper red, but green, if alkaline.

(39) Similar, in one reſpect, to the above obſervation, it may be ſaid, that among callico-printers a great point to attain in making colour, is to render
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but whatever ſubſtances are moſt proper, it is certain that on combining acids with alkalies, earths

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the articles for the purpoſe of printing, all equally buoyant. It may be ſaid too, that in all compoſitions there is the baſis which is ſuppoſed to be unalterable in its effects; other matters may be added; but from them, certain modifications only, will be the reſult; hence this principle ſhould be much thought of, that the more ſimple the baſis of the compoſition is, the more eaſy is a variation to be made; and, in a contrary light, if what is ſuppoſed to be the baſis, be compounded; as for inſtance, in a blue and yellow put together to make a green, it is highly probable that what may be added will diſagree with either the blue or yellow more than the other, and if more articles are added, the leſs certainty there can be of an effect.

In endeavouring to make a green, if a yellow feculence could be procured from a vegetable, as a blue one is, and that theſe two on being mixed, would perfectly unite, and be equally buoyant in whatever vehicle they may be uſed, there would be the ſtability required, for in this caſe, both partaking the ſame durable qualities, of courſe one would remain as long as the other, and thus the green might be ſaid to be permanent; but at preſent there is a earths and minerals, effects are to be produced ſo infinitely various, that no rule can be preciſely laid down to determine on what appearances will enſue on ſuch combinations, or how this or that particular ſalt will affect, or be affected, by this or that ſubſtance; ſee a few experiments below: (40) however, among theſe various articles

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difficulty even in rendering the pencilling blue ſufficiently buoyant, ſo as to print with it; this is however practiſed in the country, but the colour is generally uneven, and ſeems only practicable in dark grounds, from the latitude the grounding requires.

(40) If concentrated oil of vitriol be mixed with ſtrong ſpirit of nitre, or of ſalt, the acid that is weakeſt will become very volatile, and throw off very elaſtic fumes; and if put into a cloſe ſtopt bottle, would very probably burſt it: the ſame will happen by mixing ſpirit of nitre and ſpirit of ſalt together; ſuch mixtures ſhould therefore only be made when wanted.

2. Vitriolated tartar and ſtrong ſpirit of nitre, in equal quantities, diſſolved, by being heated together in a mattraſs, the ſtronger vitriolic acid will be diſplaced by the weaker nitrous one, and cryſtals of nitre will be formed from it: the ſame will happen if ſpirit of ſalt be uſed inſtead of nitre. This experiment

articles it is known that imperfect neutral ſalts act powerfully, the perfect ones but weakly;

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riment ſeems to oppoſe the general opinion, that the vitriolic is ſtronger than the marine or nitrous, unleſs it be underſtood that quantity is obſerved more than quality.

3. If vitriolated tartar, or Glauber's ſalt, diſſolved in water, be mixed with another ſolution conſiſting of calcareous earth, ſilver, mercury, lead, or tin, diſſolved in the nitrous or marine acids, the vitriolic acid will leave the fixed alkali with which it was combined, and unite with the calcareous earth, or the metal, and fall to the bottom. Any acid may be uſed for this purpoſe, for here the vitriolic acid meets with ſuch bodies as it cannot eaſily liquidate. This experiment ſhews, that the additament of water weakens the attraction of acids with alkalies or metals.

4. By dropping a ſolution of vitriolated tartar into lime, the acid will unite with the lime and precipitate with it into an indiſſoluble ſelenite, the alkali remaining pure in the water.

5. Green vitriol mixed with any ſolution containing ſubſtances which cannot be diſſolved by the vitriolic acid, ſuch as ſac. ſaturni, the vitriol will be immediately decompoſed, and combine itſelf with

ly; (in neutral ſalts the acid is the menſtruum, and the alkali the baſis, in imperfect neutrals one quality

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the lead, and thus become merely a ſolution of iron.

6. In the mixture of a ſolution of tin in aqua regia, and ſolution of ſacrum ſaturni, the marine acid will quit the tin, and unite with the lead of the ſaccharum, the acetous, or, perhaps more properly, the vegetable acid combined with the lead, will at the ſame time be kept ſuſpended, by the lead being unable to diſſolve the tin; hence both being effectually decompoſed, the mixture of courſe is uſeleſs.

7. Mild volatile alkali united with a quantity of fixed air, and poured into a ſolution of chalk in the nitrous or marine acid, will precipitate the earth, and form a true ſal ammoniac; and if the whole be evaporated to dryneſs, and a conſiderable heat applied, the acid will again part with the alkali, and unite with the chalk.

8. By mixing together, and ſubliming equal parts of ſal ammoniac and corroſive ſublimate, they unite in ſuch a manner as not to be ſeparated without decompoſition: this compound is a very powerful ſolvent of all metallic ſubſtances, even gold itſelf.

9. By pouring vitriolic acid upon any ſalt, difficult to diſſolve in water, it becomes then eaſily ſoluble; thus vitriolated tartar and cream of tartar may be diſſolved.

quality predominates) thus, making a tranſition to what is relative to dyeing, ſee note 41; allum and ſal ammoniac heighten cochineal, madder, log-

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It may be added, that on calcining fixed alkalies with the charcoal of aſhes of various vegetables, ſuch as, ſouthernwood, ſage, rue, fern, pine-tops, &c. different coloured appearances will enſue, owing (it is ſuppoſed) to ſome proportion of the oily or phlogiſtic matter (on which colours depend) of the vegetable remaining in the aſhes from which the ſalts are extracted: the ſalts thus obtained will produce different colours in the metallic ſolutions, precipitated by them, in this ſtate.

Acid infuſions heigthen red flowers in general, and many red, white and blue flowers are turned green, then yellow by alkalies, but which have little effect on yellow flowers, and ſome articles that alkalies turn red, purple or blue, are changed to a yellow by acids.—See Boyle and Lewis.

The affuſion of ley will likewiſe procure from various flowers, inſects or caterpillars, blue, purple or carnation colours, but in general, the flowers or plants that will not give a durable tinge with ley, are deſtroyed by it; there is however more hopes of faſt colours being obtained from roots.

Among vegetables on which experiments have been tried, are the hemlock, producing a green: the wild

logwood, brazil, fuſtic, &c. but Glauber's ſalt, ſalt-petre, common ſalt, and other neutrals, act
leſs

wild lettuce and thorny ſow-thiſtle, a yellow; the fungus tubolofus, a purple; and the celandine and wild patience, a blue.

In Linnæus's works, mention is made of a quantity of moſs having rotted by the ſea ſide, which produced a beautiful and durable red colour; and 2 kinds of moſs are in uſe in Sweden for dyeing red.

Were the writer inclined, he could ſwell this work to any ſize, by extracts from various works, with experimental articles, but very few would be of real ſervice, and the majority are far from being inconteſtible, (ſee note 28 in copper-work) the beſt however of the kind are to be found in Hellot and D'Apligny on Dyeing, Lewis's Notes to Neuman's Chemiſtry, his Commercium Philoſophicum Artium, and in L'Memoire d' Academé d' Art et Sciences, and various chemical treatiſes.

As for the Polygraphic Dictionary, School of Arts, School of Wiſdom, and other collections of that nature, they contain too much traſh to compenſate for what little may be valuable.

The beſt account of drugs is to be found in Pomet's Hiſtory, in Lewis's Notes to Neuman, and in the Chemical Dictionary.

It

leſs powerfully. A black is ſtruck in the above ſubſtances (madder, logwood, &c.) by ſolutions of iron, likewiſe with ſumach, galls, and other aſtringents; ſee note 25, ſolution of ſacrum ſat. acts as an alterant on red colours (as already ſaid) ſolution of copper changes logwood purple to a blue, and is reconcileable to moſt blues; ſolution of the ſuperior metals, gold, ſilver, and mercury, have the leaſt pleaſing, or leaſt extenſive effective powers; (ſee the chemical compendium) but in this reſpect, ſolution of tin in aqua regia takes the firſt rank, having a ſurprizing power of coagulating the colouring matter of many articles; thus it procures

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It is here offered to ſet perſons right in reſpect to colours, who affect to ſay, that as good or better were done fifty or ſixty years paſt, for as good were done two thouſand years or more paſt; the very means as well as articles being of as ancient a ſtanding; indeed the origin can hardly be traced: ſo in printing, the method immemorial, has been by uſing allum, &c. to procure and fix the colouring particles; it may be even ſaid, what we call new colours, have been produced many years paſt, under different appearances: if there be any real improvements, a principle one is in the mode of cleanſing the cloth, and that perhaps is only in being rather more expeditiouſly performed than before.—See three or four leaves further on, and note 10 in the retroſpect.

cures from cochineal and gumlac a fine ſcarlet; from brazil a fine red; from logwood a beautiful purple; and from weld, fuſtick, turmerick, and many common yellow flowers more beautiful colours than can otherwiſe be obtained. It likewiſe changes to a red the colour of moſt blue flowers, but as a counter-balance it in ſome meaſure deadens madder, ſafflower, and archil, and changes the vitriolic tinctures of roſes from a red to an indifferent green. (41)

Solution of tin, (it may be added) is likewiſe the beſt article to try the durable quality of a vegetable ſubſtance; for in general, where the ſolution does not deſtroy the colour, there is a probability of ſucceeding with it; but this ſolution will not combine with ſeveral ſubſtances, particularly with ſugar of lead and cream of tartar (as already mentioned) neither will it unite with any calcareous

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(41) In the vitriolic acid it brings hues from the bright pink to the flame, in aqua regia it brings a ſcarlet, in the marine it brings a dull colour.

Note, Where ſolution is mentioned it ſhould be underſtood as occaſionally diluted.

The calx of tin (Sal Jovis) is uſed in dyeing to procure the fine ſcarlet from cochineal; and in this caſe is ſuperior to allum.—See the proceſs in Hellot on dyeing. It may careous earth, nor alkalies ; but with allum it may, and is bettered by it.

The aſtringents proper for procuring the colour from madder (as already ſaid) are allum and tartar, ſacrum ſat. ſolution of iron in a vegetable acid, &c. Iron liquor mixed with the red renders it, according to the quantity uſed, chocolate, pompadour, or brown red, (as obſerved before) but it muſt be carefully avoided in preparing for pale reds.

In proving the fixity of colours, lemon-juice, vinegar, aqua fortis diluted, &c: are inſufficient, their degree of acidity being very variable ; but ſolutions of allum, white ſoap and red tartar are more proper.

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It may here be repeated (ſee note 24) that what will give colour to wool, will in ſome caſes, give little if any, to ſilk, linen, or cotton, as wool is ſuppoſed to contain larger pores, and is of an alkaline quality ; and in ſome caſes it gives different colours, ſuch as a purple to wool, while with linen or cotton it will be red.

Volatile alkalies heighten madder colour, though it hurts its permanency ; but practices of this kind ſhould not be made public, too much being done in that way, as is evident enough in country work.— See note 32 to copper-work.

⁂ It has been ſaid this is partly applicable to dyeing, for in diſcuſſing the theory of colours, it could hardly be avoided.

For diſcharging colours, alkaline ſalts only are effective where ſolutions of tin have been uſed, or the cloth otherwiſe ſtrongly coloured, and even then it requires graſs bleaching; but vitriol diluted will diſcharge colour procured from logwood, where allum has been uſed, though with more difficulty if lampblack has been added.

☞In the compoſition of penciling blue colour, by the alkaline ſalts being intimately blended with the indigo, the ſame purpoſe is anſwered as when allum or other aſtringents are previouſly applied in procuring madder colours, and by treating other articles in a ſimilar manner, may therefore be conſidered as a baſis for what is called chymick printing, or as bringing to a point what has been ſaid concerning the procuring of colours by the ſimpleſt operations; that is, where a ſaline or an aſtringent ſubſtance and a vegetable colouring one can be united, a durable effect may probably be obtained, as a great number of different coloured feculæ or dregs, are very likely to be procured from various plants, ſimilar to the proceſs for procuring indigo, woad, or archil; (42) or by precipitation in the manner of procuring calces of metals, or lakes from vegetables (ſee note 33, and end of note 40) and with proper ſolvents and thicknings might be made uſeful in printing; but, as it is not the deſign of this treatiſe to create colour-makers (43) a deal muſt not be ſpecifically ſaid on this ſcore (difficult as it certainly is, to ſteer between ſaying too little and too much) ſince common operators in that way (ſee the beginning of this ſection) notwithſtanding what has been, or may be ſaid, as adviſing a better mode, would catch hold of any thing likely to be put into immediate practice, rather than think a little and act in conſequence.

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(42) Woad is of the ſame nature; archil is procured from a moſs.—See notes 30 and 40.

This work not being addreſſed to thoſe unacquainted with the uſe of drugs, &c. and it not being intended unneceſſarily to ſwell it, the reader has been referred, (ſee note 40) to certain works for accounts of ſuch articles; but, as this part of the ſection would by many be deemed inconcluſive, without ſaying ſomething of colouring drugs, a conciſe account is therefore annexed.

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(43) For the writer's ſentiments on the inefficacy and impropriety of giving recipes for making colours, with ſome general reflections on chymick printing, ſee the end of this ſection.

MADDER, under various names, is of very ancient uſe; there are various ſpecies, the beſt is imported from the Levant, though that from Zealand is moſt in uſe; the root of the beſt is of a lively colour, and when powdered and put on blue paper inſtantly adheres; (Printers in trying it generally make infuſions) it ſhould likewiſe be paſty and unctuous, and when dried and ground ſhould not be above a year old; the red of this root is conſidered as a fixed oil united with an acid, giving it the nature of a bitumen.

WELD, of all yellow colouring ſubſtances, and there are more than of any other colour, gives with eaſe the trueſt dye, and every part is uſeful; It is cultivated in large quantities in many parts of Englnd, the thickeſt is the beſt.

FRENCH-BERRIES are uſed as a ſubſtitute, but, as well known, are much inferior in colour and durability.

FUSTICK is a ſpecies of the mulberry tree, growing in Jamaica and Brazil, it very readily gives its colour with a moderate warmth; Old Fuſtick gives a darker colour than young. Sumach and various barks have ſimilar effects.

INDIGO is of many ſpecies, it is procured by large quantities of a certain plant (ſee note 30) being highly fermented, and the feculence moulded into lumps: the ſort moſtly uſed comes from America, but the beſt is made at Java; it floats on water, is almoſt violet, and ſparkles when broken; or if expoſed to a fire, it will conſume immediately. WOAD is procured in a ſimilar manner.

LOGWOOD or CAMPEACHY-WOOD, grows plentifully about the Bay of Honduras, and lately has been introduced into Jamaica; it generally comes over in large logs.

BRAZIL is a general name for this wood, wherever procured; the ſoundeſt and higheſt in colour is the beſt; to extract the colour by water, hard water is the propereſt.

IRON-LIQUOR is generally procured by a ſolution of iron in ſtale beer; formerly it required twelve or eighteen months, though now procured in a very ſhort time; but whether in all reſpects it is the better for it, will not here be decided; however, Gatty's is now in requeſt by many printers, but ſtill good old Iron Liquor has its value.—See note 28.

OAK-GALLS are exereſcences from the ſtem and branches of the tree, cauſed by the puncture of inſects, in order to depoſit their eggs.

ALLUM, TARTAR, SALT of LEAD, &c. are ſpoken of in the compendium of chemiſtry.

KERMES, is an inſect which feeds on an aſtringent ſhrub, and though little in uſe, all allow is not excelled by any article for imparting its colour, which is a bright red, variable by uſing different ſalts.

GUM LAC is a bright red colouring drug, produced by the moiſture left by a ſpecies of ants on the branches of trees in the Eaſt Indies, which is hardened by the ſun and air: ſome think it is a moiſture which they draw from the trees.

COCHINEAL is an inſect found on the Opuntia, a ſpecies of the Fig-tree; acids and alkalies eaſily vary its ſhade; it is chiefly in uſe in dyeing ſcarlet, as a ſubſtitute for Kermes:--- The beſt carmine is made from this inſect; carmine is likewiſe procured from ſcarlet rags, by extracting the colour, which is in reality the cochineal itſelf.

Note, The three laſt articles are little in uſe among Printers (cochineal in ſome caſes excepted) but as well as Coccus Polonicus, various red and green Woods, Archil, Roucou, Walnut Rinds, Santal, and many other colouring and aſtringent ſubſtances, in uſe among Dyers, might certainly be rendered uſeful if needed, in callico-printing; hence it ſeems a reprehenſible circumſtance in many Printers, treating the art of dyeing with little concern; for the principles of it include the foundation of printing, as far as procuring colours are the object; conſequently, thoſe who wiſh to extend their knowledge, whether for amuſement or intereſt, might undoubtedly find advantage in peruſing works, either on the theory or practice of dyeing; and therefore the writer has occaſionally had recourſe to it (ſee note 41) but, however improvements in any ſhape may be recommended, deviations from efficacious and eſtabliſhed modes ſhould not be made without proper reflection, much leſs from a mere love of innovation, for every innovation is very far from being ultimately an improvement, or otherwiſe advantageous, and articles already are perhaps not ſo much wanting as a proper uſe of them, by bringing them under ſuch regulations as to enſure ſome certainty of effect in their application

4th. *Of the Application of Colour in the Operation of Printing.*

As every Colour-maker muſt grant that he cannot always enſure any particular piece to be ſo well executed, as that his mixtures ſhall have their proper effect; or that any two or more pieces ſhall be alike at the laſt ſtage, it muſt be allowed it is neceſſary to enquire into the cauſes; if on enquiry they are not clear, there certainly is a probability of their originating in ſome circumſtance that has paſſed unnoticed, or been really thought not worth noticing; the buſineſs then is to endeavour to develope theſe cauſes; for a circumſtance trifling in itſelf, or little obvious in its beginning, may lead inſenſibly to others, till a number being accumulated and combined, the conſequences then are viſible enough to make them a matter of importance: this therefore is one idea in taking up the ſubject of this part, and a few obſervations will accordingly be offered on ſeveral circumſtances attending it: beſides, as they are intimately connected with the operation of printing, of courſe they may not be unworthy a printer's conſideration, eſpecially as it may be added, that it includes the theory or principle of printing itſelf, which is, that according to the blow or impreſſion given, the colour is received by the cloth, and the intended effect, as far as printing is concerned, is or is not obtained, allowing for the ſtate of the cloth, colour, ſieves, &c. for it may be ſaid, that if there be any need for ſtriking any print or ground with the maul, why ſhould not all be ſtruck alike? but to this it is aware it may be replied, that a line will give the colour eaſier than a ſolid, and, to view it rather philoſophically, a ſolid may be conſidered as an aſſemblage of lines or points, therefore the ſmall force needful to cauſe a line to furniſh, muſt be increaſed or multiplied, to cauſe the body to furniſh in proportion: but be this as it may, it ſeems to be among thoſe circumſtances that cauſe appearances not at all expected, and therefore whether the obſervations here made, have any weight or not, the principle on which they are raiſed, cannot to a thinking Colour-maker be totally unworthy his regard; for as before intimated, merely making colour is no great ſecret, nor is it treated as ſuch (ſee note 48) the grand matter being in accommodating it to the cloth under all poſſible circumſtances, and until he can do that with ſome certainty, he has ſomething to learn.

Of Colour-making.

Proceeding now immediately to the ſubject, it is certain that in colour-making, the operator either does, or ſhould, attend to certain proportions in mixing his drugs and other articles, according to the ſhades that are required, the quality of the cloth, and the articles uſed for fightning or thickning, which when done, he generally thinks himſelf ſafe; as having acted at leaſt according to rule; or if he ſaw the pattern, according to the appearance of that; and if the colours were all worked by the ſame printer, and ſimilarly managed in every particular, the effect might be as required; but that is often far from being the caſe, as for inſtance, among innumerable circumſtances it might probably happen thus with a pattern that may have three reds and three purples; one printer may have the brown red, another the pale reds, and another the purples, as they ſucceed each other in the application; now the printer with the brown red may deem it needful to give it two or three ſmart blows with his maul, the next printer or grounder in putting in the other colours or ſhades deems it needful to hit the grounds but ſlightly, and perhaps the paleſt ſhade may go iuto another's hands, who may hardly hit it on the back at all; while the purples may be treated in a direct contrary manner; therefore here it muſt ſeem that the ſecond red will not be impreſſed into the cloth like the firſt, nor the third like the ſecond; conſequently, the ſecond will be a degree paler than required, and the third two degrees; but, on the contrary, the ſecond purple will be a degree ſtronger than it ought to be, and the third two degrees, which will deſtroy the balance of ſhade, that ought to be preſerved. (Nothing is ſaid yet reſpecting the ſtate of ſieves, bruſhes, ſtowing, &c. as the bad ſtate of either muſt aggravate the caſe.) Hence it muſt ſeem, that whatever pains the Colour-maker took to proportion his ingredients, and to adapt them to the cloth, or the ſightning and thickning, the grounds have not been treated ſo as to produce the requiſite degrees of ſhade. (44)

Or, The matter may be thus illuſtrated: The outlines of two patterns may be nearly alike, but probably one may have a greater quantity, and larger bodies of pale reds than the other; and the other may have a ſuper proportion of the pale purple; or in one the ſhades, or other parts may be in ſmall bodies, ſo that wood only will be ſufficient to work it, and in the other there may be bodies that require hatting, though the patterns in appearance may be of one claſs; now in this caſe, (45) if the Colour-maker ſee the patterns only, (46) it is a chance if he makes any difference in his proportions according to theſe circumſtances; for the flowers or other objects ſeeming to him to conſiſt of three regular ſhades of colour, either as reds or purples, the proportions for one pattern may be deemed needful for the other; but when the grounds go to work, they may receive different treatments from each other; hence the ſhade of colour that will be but barely deep enough for the purple or red ground that has large bodies, and which accordingly will be ſtrongly impreſſed on the cloth, by ſeveral blows with the maul, muſt be too weak for the red or purple of the other, that may be juſt ſtruck with the Printer's hand; or one ground, becauſe of the ſhades or fine lines, may be worked in paſte, while the other may be worked in gum; the conſequence however will be, that though the two pieces have the outlines alike, yet the paler colours in the ſeparate pieces muſt be different in reſpect to the requiſite ſtrength of them.--- as obſerved in note 8 of copper-work.

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(44) See note 8 in copper-work where this circumſtance is illuſtrated.

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(45) It is ſaid, "in this caſe," becauſe in others where two patterns differ very much in their appearance, it is very likely allowed for.

(46) It is not always that he even looks thus far, though if there be any weight in theſe ſuggeſtions, he ought to look at all the prints and grounds.

Theſe obſervations may be brought ſtill cloſer, as for inſtance. Two pieces are to be printed with the ſame colour, but with different prints; one print fine and the other coarſe, or with ſolids in it; therefore very probably that with the ſolids will be more impreſſed in the cloth than the other, from its being deemed neceſſary to hit it more forcibly; hence though the colour for both pieces come the ſame from the colour-houſe, the effect may be different in the ſhade of the colour: and in printing doppies it ſometimes happens, that if a piece is not thoroughly dry, or if it be of a flimſy nature, the colour may be forced through, (47) while another more dry, or of a firmer texture, will reſiſt that circumſtance; therefore here again, though the ſame colour is uſed for both pieces, yet one will have a paler or more waſhy appearance than the other; and the moſt ignorant Printer knows, that if a ſhop be not kept warm, it is dangerous almoſt to work any colour; (ſee note 34) and that it is always beſt to finiſh a piece, though the colour may be uſed out of the ſame pan; a difference may ariſe too from colour being old or freſh; and to all theſe may be added the chance of ſome part being performed with foul bruſhes or ſieves, worked on hard blankets, or from coarſe ſieves, lying on very ſtiff gum or paſte; or ſome pieces may be worked with the firſt colour without

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(47) Here it might ſeem to many, that cloth being ſo thin, this is a matter of indifference, but when it is conſidered, that the aſtringent and colouring atoms are ſo ſmall, that a great number piled on each other would bear no proportion to the

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the thickneſs of the cloth (ſomething ſimilar to the microſcope diſcovering thouſands of animals in the breadth of an hair) it muſt then appear otherwiſe, and muſt accordingly be of ſome importance whether they are only on the ſuperfices of it, within the body, or whether they are forced quite through; in the firſt caſe the tinge can be but weak, in the ſecond it is likely to be more effective, but in the laſt the atoms muſt be too much diſperſed for procuring that cloſely connected body or maſs of colouring particles which is requiſite.

out being drawn over the ſtove; or perhaps taken to the copper without being properly ſtowed; while other pieces are treated in a direct contrary manner.(48)—See again note 34.

It is likewiſe of ſome conſideration, upon an optical principle (ſee rule 8 in putting-on, and 7 in cutting) whether pale colours are near to or encloſed with ſtrong bodies of dark colour, for what may appear of one hue, ſtanding by itſelf, or only near to, or encloſed with a fine line, will appear of another if otherwiſe circumſtanced.---See likewiſe note 37 in copper work. but in reſpect to ſhade, it will not appear ſo dark when ſurrounded by a maſs of dark colour, as when alone on a white ground, owing to the contraſt.

Theſe circumſtances, and more that might be adduced, are, it is preſumed, of conſequence enough to engage a Colour-maker's attention, for though on the ſuppoſition that he has proportioned his ingredients to the kind of cloth, the pattern, and the nature of the thickning, yet it muſt be evident that unleſs each colour or ſhade, is in its applications ſimilarly managed, according to the proportions given, its effects in the end muſt be different in a greater or leſs degree from what was intended.

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(48) Some printers will, if they can, ſometimes ſmuggle as it were, pieces without being ſtowed, in order to have them ſtiff, though at times very improper ſo to do, as ſome calenders are not in very dry places, or the cloth itſelf may not be ſufficiently dry when taken to the calendar.

As to the Printer, he generally regulates his blows or preſſure by the quantity or quality of colour, or whether his print or ground be hatted or not; but even here, ſome Printers dip and lay their prints ſo ſlowly, and hit ſo ſluggiſhly, to what others do, that even this circumſtance may aggravate the others, for there are ſome colours that dry very quickly; therefore (it is repeated) though one or two of the circumſtances juſt mentioned may poſſibly be of little conſequence, yet when all or moſtly all are joined, it then muſt be allowed by every one to be of ſome weight; as for the ſhare the Copperman has in this caſe, it depends on what manner the mixtures are imbibed by the cloth, ſuppoſing the preparation, &c. to have been properly executed, and the drugs, &c. proper;(49) for if, of a number

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(49) This renders dyeing but a ſimple operation compared to callico printing, as in the management of the preparation, it is only relative to the different kinds of articles to be dyed, as intimated in the beginning of this ſection; hence it may be ſaid in Colour-makers language, that thicknings are more wanted than colouring articles.—See note 39.

Note, Here at the top of the Table ſhould be prefixed the kind or quality of the material intended to be printed on; of courſe, the Table muſt be repeated for every article that requires a variation of the proportions, ſuch as Muſlin, Callico, Cotton, &c.

Blotches in	Preparation.			Colour-Making.										Raiſing the Colour.				
	Water	Alkali	Acid, &c.	Water	Iron liq.	Galls	Allum	Sac. Sat.	Tartar	Starch	Time of boiling	Do. of macerating.	Gum, &c. ſee note 39 and liſt of drugs note 20.	Water	Bran	Dung	Madder	Weld, &c.
Black																		
Chocolate																		
Pompa.																		
Firſt Red																		
Sec. ditto																		
Third do.																		
Pink																		
Bloſſom																		
Sec. Purp.																		
Third do.																		
Laylock																		
Dk. Olave																		
Sec. ditto																		
Third do.																		
Drab																		
Yellow																		
Buff, &c.																		
Doppies in Do. repeating the above liſt.	Here and in the following compartments, where needful, repeat the above diviſions, varying the proportions of courſe.																	
Cloſe coveringwork in Do.																		
Light work in do																		
Cylindrical work																		
Copper-plate work																		
Gds requiring heavy blows																		
Do. requiring light blows																		
Do. requiring preſſure only.																		
Do. with lights.																		
Do. with boundage																		
Do. without.																		
Do. near another colour.																		
&c. including china blues, and chymicks, according to all circumſtances that can poſſibly be ſpecified.																		

N. B. Perhaps it may be beſt to have ſeparate tables for Chemicks.---It is however begged to be remembered, the above is only a crude hint towards a proper table.

The writer is ſorry he was too late to avail himſelf of Mr. Henry's *paper on dyeing, in the laſt* (5th) *vol. of Mancheſter Phil. Tranſ. which every callico-printer ought to conſult.*

Though nearly repeating what has been ſaid, it is here obſerved, that it would not be diſcloſing ſecrets to ſay, by way of recipé, that to make Black colour, take ſo much Iron liquor, ſo much water, ſo much flour, boil them ſo long, &c. or ſo much alum, ſo much Sac. Sat. &c. for other colours; for the ſecrets are in a rigid attention to thoſe circumſtances under which they may be applied, and all theſe cannot be ſpecified in a recipé: nay it may be gathered from the above Table, reſtrained as it is, to ſay nothing of the neceſſary repetitions of it, how many circumſtances are to be provided for, which experience muſt aſcertain, and which muſt evince the abſurdity of the idea (ſo often intentionally enforced) that merely exhibiting recipés will form a Colour-maker or Callico-Printer. As to certain projects (ſome already ſpoken of, ſee note 42 and text above it, on the ideal hope of uniting the aſtringent and colouring qualities in the ſame article) among which at preſent is the idea of raiſing ſeveral colours at once, by the agency of a certain weed, though the neceſſary proceſs precludes proper permanency, the writer muſt ſtill re-iterate the propriety of firſt attaining more certainty in the preſent practice, as that would lay a proper baſis for improvement (See Preliminary Suggeſtions, notes 39, 49, 50 and 52 to this ſection, and elſewhere.) And may it be here ſaid to ſome (even to Chymiſts in their Laboratories) who hitting on this or that tinging article, conclude they have gained the point; that in reſpect to Callico-Printing, it is but advancing one ſtep towards it (in Dyeing it may probably be ſufficient) for, if the writer may ſo ſpeak, till the tinging article, according to Hydroſtatic laws, is of equal ſpecific gravity with the buoyant one (the thickning) it muſt neceſſarily either ſink, float at the top, or fly off in fume or vapour, by the attraction of certain ſubſtances or qualities of the atmoſphere, as in the inſtance of pencilling blue.*

As to other certain impediments, thoſe only who are well acquainted with the buſineſs, can have a conception of them. It may nevertheleſs be ſaid, in reſpect to Printing in common, that on the Continent Principals being more arbitrary, as well as more philoſophical than thoſe here, are abler to manage and direct workmen than can be done here: thus it is uſual there for one workman to put in the Black, another the Red, and ſo on: but dare the firſt Printer we have attempt ſuch a mode, proper as it moſt aſſuredly is? no, on the contrary, men here are ſo much maſters, that too often regularity muſt ſtoop to confuſion, propriety to abſurdity; and judgment itſelf to downright ignorance!!! Hence one great cauſe of uncertainty.

Scheme of the principal proceſſes of Callico-Printing, more fully exhibited further on.

1ſt Drawing, Cutting, Engraving.
2nd. Colour-Making,
3d. Preparation, Calendering.
Printing.
Stowing, Clearing,
Raiſing the Colour,
Blue dipping, &c.
Fielding, Pencilling,
After-courſes.

4th. Accounts at home. Town Buſineſs, &c.

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* The writer thinks an apparatus might eaſily be procured for keeping certain colours, while in the pans, always in motion.

ber of pieces boiled in the ſame copper, one colour comes up perfect, it is a proof he has done his part.—See note 8 in copper-work.

From what has been ſaid, it ſeems that a Colour - maker ſhould either be a Printer, or be able to put himſelf in a Printer's place, chiefly in reſpect to the printing apparatus being in order, and (as already ſaid) likewiſe in the Copperman's, particularly in the preparation,(50) ſo

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(50) It has been mentioned to the credit of the firſt printing - houſe (in reſpect to the quantity of work done at it) in the vicinity of London, that the copper work is well attended; it is certain too that the ſame attention is beſtowed on the printing, one of the Principals having been a Printer, and being able to command every convenience, it is of courſe the better for it; and Journeymen having a maxim (as mentioned in the ſection of printing) that a Printer only ſhould overlook Printers, are perhaps more to be influenced by ſuch a one; whether this is the caſe or not, certain it is, that much depends on the cleanlineſs of bruſhes, ſieves and pans, eſpecially when pale colours are uſed; indeed grounding

ſo as to have the chief circumſtances properly arranged, that may aid or attend the application of his mixtures; but at the ſame time it is granted, it muſt be an extraordinary attention indeed, that can nearly keep in view the almoſt infinite caſes under which colour may be applied, to ſay nothing of having to combat with indolence, ignorance, careleſsneſs, prejudice, or malevolence;(51) and ſometimes, though rarely, over-zealouſneſs.

To

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ing ſhould be done in a ſeparate ſhop, and the apparatus of courſe be by itſelf.

A remark is here ventured on, which if narrowly looked into, will be found not very wide from truth; that according to the branch a principal may have been brought up to, or moſt engaged in, that branch will moſtly engage his attention, and his aim for excellence will tend chiefly to it.

(51) It is repeated here (ſee note 33 in maddering) that white goods laying in a heap may receive an injury which may affect the printing; it therefore evinces the neceſſity of the proceſſes antecedent to printing being carefully attended; but for theſe as well as every other proceſs, to be done properly, is unhappily not in the power of all Printers; ſome will not have the conveniencies ne-

ceſſary

To lay down a plan to regulate theſe applications, would probably be ſpurned at by old practitioners; as it is hardly probable any that could

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ceſſary, and ſome cannot have them, conſequently when the means are obſtructed, the execution muſt ſuffer. As to thoſe who with ſuch a complex buſineſs on their hands without either means or capacity, or who under the infatuated idea of being maſters, have precipitated themſelves into it without proper ſupport, they are really to be pitied, for when raiſing ſupplies become ſo preſſing, that (as in the memorable failure of Moſney-Houſe dwelt on in another place) the buſineſs in the operative part is but a ſecondary concern, any one may judge how confuſedly it muſt be proſecuted or diſcreditably terminated.

Remarks like theſe may appear invidious, but if they cauſe any who are inclined to commence callico printers to reflect ſufficiently on the nature of the buſineſs, the writer is not apprehenſive of meeting with cenſure for ſuch freedom, being certain that he has done a real ſervice.

He likewiſe cannot here forbear giving a hint of advice to the Printer, and he will add, that it is of conſequence to a Draper to attend to it; for unleſs a Printer can evince his capability of executing work properly, the Draper has a chance of loſing, could be ſpecified would be reconcileable to anther's requiſite mode of practice. It may however be ſuggeſted, that if a Colour-maker would arrange

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as it is preſumed to be more acceptable to have goods returned well executed, than to have to lay damages as ſome compenſation for bad work; beſides, a Draper ſhould not only inform himſelf whether a printer can execute what he undertakes, but whether he can do it in proper time (chemical and general patterns are not here included.) A circumſtance of this nature not being attended to, was the ſubverſion (or at leaſt forwarded it) of a conſiderable printing-ground at Old Ford (Lay and Adams) a few years back, the Principal having undertaken late in the Autumn, to execute for the Spring, a conſiderable number of very elaborate patterns; but though every nerve was ſtrained, the effort was in vain, and as well as the Printer being overturned, the Draper muſt have ſuffered.

What helped to raiſe the names of Newton and Kilburn to ſuch diſtinction, was in their outſet being forward with their work, as well as excellent in general in the execution; and much was it regretted then, by the lovers of excellency, when the firm was diſſolved; though the exertions and productions of each ſince that circumſtance, have been ſtill ſo reſpectable, that Callico-printing in England arrange the different courſes of operation his colour has to go through, * in regard to the texture of the cloth, ſtate of the prints and grounds, blankets and ſieves, thickning, preſſure, &c. the operations might be reduced into ſome ſyſtem beyond what is at preſent done, which is rarely more than proportioning the ingredients for fine or ſtout cloths, blotches, and fine prints and grounds; for certain it muſt be that according to the proportions or manner in which the iron liquor, allum, &c. is imbibed by the cloth, whether from

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gland may be ſaid to owe its revival and preſent credit to their efforts; 2 or 3 other Printers are certainly entitled to commendation; but not ſtanding ſo forward in the articles of novelty and taſte in deſign, or brilliancy in execution, they are not particularly pointed to.

* Even in nearly the laſt proceſs, that of whitening printed goods, a careleſs Fieldman may render all that has been done abortive, eſpecially in ſtrong ſun-ſhiny weather attended with a drying wind, if goods are watered in patches, or ſuffer too long an interval between watering: the miſchief will be ſtill more obvious, if pale colour work, ſuch as laylock, bloſſom, or other pale blotch grounds, are thus treated—See the article Graſs Bleaching.

the manner of their being mixed, or their treatment in the printing ſhop, the colouring drugs can only impart their qualities towards giving the effect that is deſired.

The writer however preſuming that a Table ſomething like the oppoſite, with the proportions annexed to the different circumſtances under which colour may be conveyed, inſerted according to each Practitioner's mode, would often be uſeful, he has therefore offered one; leaving the blanks to be filled up according to each Operator's diſcretion, or courſe of practice; or it may ſerve as a kind of model at leaſt, for a better.

Adverting now to the inefficacy of written recipes for making either permanent or fugitive colours (as obſerved note 43, and in two or three other places) it is here ſuggeſted, that the moſt explicit modes of diſplaying them will never form a Colour-maker, as ſo many practical circumſtances occur, which there is no language to deſcribe, and for which experience alone can provide (52) (ſee note 4 of copper-work) but excluſive of all this, as every Printer is ſuppoſed to know the common routine of colour-making, and many will ſay, they know as much as can be known (ſee notes 4 and 10) it would be folly to attempt publiſhing recipes, unleſs every one excelled in ſome eſſential part, all that they or others knew; but where is the man who will pretend to diſplay ſuch? or even granting it were done, where is the Practitioner, who from motives of one kind or another, would allow it to be done, or ſtoop to adopt much of what might be diſplayed? hence, (as ſaid note 16 in copper-work, and at the cloſe of the ſame ſection) it is more prudent, and perhaps more uſeful, and, as it might injure thoſe who make a living by their poſſeſſion of recipes, it muſt be more conſiderate in another ſenſe, to ſpeak generally, rather than ſpecifically or poſitively in practical matters; and in diſcuſſing the theoretical part, recommend the ſtudy of it, or point to the means, rather than confidently offer to exhibit

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(52) Such as the different kinds and qualities of cloth, the proportions, ſightnings, and thicknings of

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of the colour requiſite for each; the mixing, boiling, application, &c. of them, in reſpect to time, quantity, quality and materials: the cuſtoms of particular places, caprice of Principals, obſtinacy or ignorance of thoſe who have to uſe them, &c. &c.

them; for to thoſe ſo diſpoſed to enquire, practical knowledge will be obtained much more perfectly than ever it can be gathered from books of any kind whatever: even what the writer has attempted to diſplay on the applications of colour by printing, is little more than mentioning ſuch circumſtances, and leaving others to form concluſions; for practice and experience, it is again ſaid, muſt ſuggeſt the moſt efficacious means of rendering ſuch obſervations, or any others that can be made, uſeful in any reſpect; but this, it is apprehended, need not be further dwelt on here, as it is more than once intimated the ſlender efforts in this work, are with diffidence offered to induce certain practitioners to think, not arrogantly to direct any how to act. (53)

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(53) As illuſtrative of the above ſuggeſtions it may be obſerved, that works avowedly written for the benefit of Manufacturers or Artificers, often contain ſo much ſpeculative and ſcientific matter, that ſuch perſons are rarely benefitted; as their ideas in general reaching little beyond practical concerns: this may be oweing to few Manufacture rs or Artificers being writers, or having time to write, or perhaps from dreading the auſterity of criticiſm; hence that employment reſts more with writers by

Reſpecting chemical colours ; there is a greater plea for withholding recipes, for granting (only for a moment) they could be improved, ſo as to equal thoſe brought up in madder, (and the field for diſcovery is very wide, and ſome are very ſanguine in this caſe) yet there are conſiderations that deſerve notice, which weigh againſt the univerſal adoption of ſuch a mode of printing, with all its boaſted advantages ; for when once operations were ſo known, as to be performed in a ſhort time, with little trouble, and ſmall expence, numbers of indigent or deſperate adventurers would naturally ruſh into the buſineſs; and by their mutual underworking and underſelling efforts, Callico-printing would ſoon loſe its

reſpectability

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profeſſion, and their diſcuſſions, as mere Theoriſts, are more apt to be philoſophically amuſive, than operatively uſeful ; even thoſe great works, the French Encyclopediæ and Memoirs of the Academy, may be complained of on this ſcore (to ſay nothing of their high price preventing moſt Artificers from purchaſing them) the writer's not having been able to procure the neceſſary practical information, or if they procured it, they could not always explicitly and ſatisfactorily convey it to thoſe who were moſt intereſted in it, to whom it would be moſt uſeful, or who were moſt likely to render it uſeful to the world in general.

reſpectability; and (in the Draper's phraſe) prints in general becoming vulgar, and within the reach of thoſe who have but little to ſpare, other articles muſt be ſubſtituted more worth the notice of perſons of faſhion, or taſte.

Beſides, ſince moſt Drapers, by a certain criterion, know whether ſome kinds of work are faſt or not, there is a neceſſity for Printers to keep up, at leaſt, a line of reſpectable work; otherwiſe Drapers would naturally expect it executed for little, and then they among themſelves, would contend (by practices too common already) for the greateſt number of purchaſers, till prints, conſidered in this light, likewiſe become of little value; and it needs hardly be ſaid that with Drapers, retailers particularly, that work is deemed the beſt which brings returns the ſooneſt, however ſmall the profit.

It may be added, that by the adoption of an univerſal chymic mode, a national or commercial injury would be experienced; by many articles, now in uſe for procuring faſt colours, being no longer wanted; which includes the loſs of employment thouſands muſt ſuſtain, whoſe living depends on the cultivating, manufacturing, and the conveying of ſuch articles from place to place; but mechanical or other improvements neceſſarily ſuperſede theſe conſiderations. Though after ſaying thus much, it muſt be added, that, until every Printer thinks it no way diſcreditable to be deemed a chemick Printer, or every Draper cares as little about his ſhare of repute in vending chemick work, permanent printing on the preſent eſtabliſhment muſt retain its ſtaple value.

Purſuing this ſubject a little laterally, it may be obſerved to chemick Colour-makers, who make a parade about this or that colour or ſhade, that ſuch matters rarely give a turn to a ſtile of work; figures or ſhapes being more the eſſential parts, and a mere chemic ſtile of work performed on any material, every one knows, has but its day.

Thus in chemick printing, as far as the writer's memory reaches, Arbuthnot made ſome ſtir with green ſtalks in light chintz, which ſoon flew, and no proviſion being made to ſupply the vacant parts (ſee the latter part of the ſection on pattern drawing,) the cloth then had a truly ludicrous appearance; the flowers ſeeming ſcattered here and there without ſtalks or any other appendage. Preſton's chemical courſe on various materials, a few years afterwards, made ſome noiſe, but an idea prevailing, however unjuſtly, that it was by oil colours, and that the heat of a fire ſide would deſtroy them, that courſe ſoon dropped. Het's came next, but his ſtile as well as Preſton's was very confined and ſhortly ſubſided: black and orange, or (as commonly called) gold colours and other coloured ſhawls, came next in vogue; ſaid to be Naylor's invention; other fancies, ſuch as ſpringeing or ſplaſhing, ſoufflee, &c. might be added; with the blue and buff lately much in requeſt, and laſtly the kerſymere waiſtcoat ſhapes, but none of theſe ever ſtood the proofs of a properly faſt colour; as to the blue and gold, or black and orange, continued to this time, and even introduced into furniture, (and which as well as the black dove and yellow ſtile, from the eaſe and facility of its execution drew many unto the buſineſs, that perhaps now wiſh they could elegibly quit it) as proving what has been juſt ſaid, it has decreaſed from twelve-pence and more per yard for printing, down to three halfpence, or even five farthings!!! (54) and probably black, dove and yellow would have experienced a fate ſomething ſimilar, but neatneſs and fulneſs were generally required, and reſpectable Printers did a deal of the work.

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(54) It is notorious that in many commiſſioned and other ſhops, the loweſt chemical work, even with

In ſhort, as theſe courſes are little to the credit of callico printing, it prompts a ſuggeſtion, that to reſtrain them within proper bounds, it would ultimately be of general ſervice if ſome ſuch regulations were eſtabliſhed as are in France concerning Dyers; thoſe who dye faſt colours and thoſe

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with ſuch colour as almoſt, literally ſpeaking, would ſhake off, is warranted and ticketed as faſt, and often called chintz; and as one conſequence certainly is cauſing purchaſers to be doubtful of all kinds of work, it would here unheſitatingly be ſhewn how to know at ſight which is ſo, if it could be done perſpicuouſly; as to ſaying that cheap ticketed work is ſuſpicious, is what every one knows; and when little more is given, whether through neceſſity or choice, than what the cloth is worth, no one can reaſonably complain; but very often a high price is required, and freely given in expectation of adequate work; In ſome caſes it muſt be however allowed the impoſition reſts not with the Draper.

thoſe who do not, being deemed of diſtinct profeſſions, and faſt and fugitive colours confined to certain kinds of cloth.---See in the general reflections more to this purpoſe, as well as the means of improving Callico-printing.

End of the Section on Copper work and Colour-making.

Enlargements on the preceding ſubject, being a more chymical diſcuſſion of it; or, in which the agency of chymiſtry is more exemplified, both theoretically and practically.

HAVING attempted to give a general view of preparing and colouring proceſſes, as accommodatory to the ſtate of philoſophical knowledge among thoſe to whom the work is addreſſed, as perhaps can be done, the writer now, in order to lead them as it were ſtep by ſtep to the point he wiſhes them to attain, will endeavour to be a little more ſcientific, and ſpeak more particularly of the operations of nature in thoſe proceſſes, in view of rendering them uſeful or ſubſervient to the operations of art. And, as failures in practice are as much owing to improper qualities in the articles employed, as well as in the unions and applications of them, he will ſubjoin ſome certain modes of analyzing them, partly from experience and partly from reſpectable printed documents: but ſtill expreſſing himſelf in as familiar terms and language as he poſſibly can:---as what he has ſaid reſpecting coppermen (note 34 to maddering) may be ſaid reſpecting the maſs of colour-makers (he ſpeaks here from certainty and dares refutation) for being little ſolicitous about principles or cauſes, and little acquainted with the proper names of articles which they uſe, the modes of analyzing them, or the true ſignification of chymical terms in general, it probably would be of little advantage, nay it would appear like vanity and affectation, to uſe the new terms of chymiſtry (55) expatiate on new theories, or diſplay certain new opinions, or even facts, though relative to the ſubject. (56)

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(55) Called the new nomenclature, which at a proper time is intended to be given with new opinions, experiments, &c. included in what is intimated note 7 to preliminary ſuggeſtions.

* Among abſurd phraſes in general uſe, are killing acids, opening indigo, verdigreaſe, and the like. The abuſe of the term colour has been mentioned,—ſee note 1.

(56) And has given ſo ſlight and imperfect a compendium of chymiſtry as to omit ſome of the metallic

The time however he truſts is haſtening when philoſophical principles will be cultivated (57) the neceſſity of it becoming every day more evident. He will even venture to ſay, when this crude treatiſe is ſcanned, and he has ſufficient reaſon to ſuppoſe it will be by many in the profeſſion, however cavalierly he treats them, that a deſire for better information will commence, and, of courſe, an endeavour to obtain that knowledge which is the proper baſis of practice, and which as ſuch is ſo often ſpoken of in this work.

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metallic ſubſtances, moſt of the acids, and intirely the gaſſes, though important primary agents in the new chymiſtry.

To thoſe who have leaſt ſpare time, are recommended as a ſelection of works on chymiſtry, firſt Nicholſons Elements, then Fourcroy's and Lavoiſier's, but chiefly Berthollet's Memoirs, of which the writer has often availed himſelf in this work.

(57) Probably the preſent diſtracted ſtate (1790) of France, may cauſe ſome of her ſcientific artiſts to migrate; of courſe, where they go, they will carry ſcience with them, and callico printing in this country may be bettered by it.

Concerning permanent BLACK and PURPLE.

Iron-liquor, or calx of iron diſſolved in vinegar, from whatever liquor procured, is the agent for obtaining permanent black from madder; and by judicions tempering with water forms purples and laylocks;* the black itſelf being only a deep purple :---With logwood a leſs permanent black or purple, of a bluiſh duſkier hue is obtainable. With weld and other yellow colouring ſubſtances, the hue is brown. When added to the red colour, or more properly the aluminous ſolution, then chocolate, pompadour, bloſſom &c. are formed in the madder copper, according to the proportions of mixture, from the colouring matter being taken in combination by both the calx of iron and the earth of allum at the ſame time.

Some think the additament of alder bark, or decoctions of other aſtringents might help the iron liquor in certain caſes, as when newly prepared or procured by a weak acid.

Of the tar acid iron liquor, or the chalybeat one, the writer will ſay little; the expedition of procuring either may have its advantages, but much caution is needful before a courſe of work is attempted with them, unleſs the manufacturers are of undeniable repute: for though a deal may be ſaid of the acid employed and of its immediate operation on the previouſly prepared calx, yet every printer, as already obſerved, is fully ſenſible of the value of good old iron liquor, and of courſe preſerves it for particular purpoſes.

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* Uſing paſte or gum occaſionally as thicknings, or vehicles for carrying them to the cloth.

As to what is ſaid by ſome of the acid procured from cyder, perry, &c. and uſing ſteel filings, it ſtill is but vinegar, and the ſteel muſt be converted into a calx before a drop of iron liquor can be formed. Hence the only ſuperiority it can boaſt over any other, is in its being fre-er in its firſt ſtages of manufacturing from uſeleſs or injurious matters; and from the iron being very minutely divided, and, of courſe, preſenting more ſurfaces to the action of the acid, the ſolution is more expeditiouſly performed.

It may not be irrelavent to add, that the more concentrated the vinegar, or the nearer it approaches to diſtilled or radical vinegar (58) it

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(58) Vinegar diſtilled from verdigreaſe; but to ſpeak of this as well as other articles, new terms

may be proportionably effective, both in reſpect to power and expedition: and ſmall beer or weak wines are known to give of little power. As to the age of common iron liquor, that is, ſuch as is procured in the old way, it is indiſputable that the particles of iron or its calx are found to cauſe a finer colour and of being more uniformly diſperſed, however lowered the mixture may be, than in the new iron liquors. In fact, it is this perfect ſaturation, and the caſe is applicable to aluminous and other ſolutions, that denotes its excellency. And this is no where more evident (as well as with the red colour) than in the charging of copper-plates, where the engraving is very fine: for it is certain that the colour made at different grounds by different operators, will not ſuit the ſame engraving. Other circumſtances to be ſure may intervene, yet the above

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of doctrine muſt be uſed, at preſent deemed incompatible

As vinegar diſſolves iron ſlowly, and only then with acceſs of air, the tar acid, or more properly the acid of wood, has been lately much uſed and extolled, being applied immediately to the calx.

above is certainly one worth attending to (59) But in this inſtance it may be ſaid in one caſe, that, by the particles of iron being more ſaturated with the liquor, and in the other by the earth of allum being completely ſaturated with the vinegar, of courſe, both the calx of iron and the earth of allum are carried with their ſolvents into the fineſt interſtices.

N. B. With blue colour for copper-plate printing the difficulty is greateſt ; hence the colour here cannot be too pure and free from adventitious matters, not only for filling the interſtices, but alſo for the ſake of the doctor or clearer.

Perhaps what tearers call vittry colour, or that which in boiling, or other ſtages of preparing black, appears frothy, ſcummy, lumpy, &c. is from the iron liquor not being free from plumbago (which is a combination of the baſe of fixed air or pure charcoal with iron. Of which much might be ſaid, but for reaſons juſt given, it is waved at preſent, except that being black lead, it is inſoluble in acids.

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(59) The perfect digeſtion of galls and other aſtringents; or their ſaturation with their ſolvents, is as fully needful in certain courſes; for in both caſes, the extreme diviſion of the particles produces the beſt effects.

In the copper a decompoſition of the liquor takes place either by attriction (note 28) or by an attraction of the colouring matter of the madder, or elſe by an attraction of the cloth itſelf (60) to the calx held in union by the vinegar: which in this caſe is ſimilar to the earth of allum in combination with vinegar.

The writer will not yet pretend to ſay how the foxing of the purples (a common phraſe) may be avoided with little trouble, but he obſerves as it is ſure to take place if the water be heated to a certain degree, it renders the purple an iron mould, or a metallic ſtain; the combuſtion having decompoſed it, and ſeperated the colouring matter from it. For here be it obſerved that the purple on the cloth is a compound matter, formed of the calx of iron and the colouring matter of the madder.

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(60) The lateſt modern opinion is that the cloth itſelf in the copper undergoes a partial ſolution.

Why the red is not ſo eaſily decompoſed is from the cloſer attraction of the colouring matter of the madder with the earth of allum: and it has been obſerved, the black and conſequently the purple is deemed only a depoſition of the calx; beſides, as a proof of it, it is known that the deeper the purple, the eaſier it is affected, which only ſeems ſo from there being more ſubſtance to be acted on.

In maddering if the heat be too intenſe, a ſimilar circumſtance happens, that is, a browneſs enſues, ſo likewiſe does it in mere welding; only in the firſt caſe the colouring ſubſtance already on the cloth is changed, but here the colouring matter of the weld in the copper is changed, combuſtion being the cauſe of both.

Note An iron liquor, not generally known, is obtainable from a decoction of rice in which red hot iron is thrown; it is then to be added to a certain quantity of vinegar in which red hot iron has likewiſe been thrown.

Concerning permanent RED.

Allum, (that is, vitriolic acid and clay,) being mixed in ſolution with ſugar of lead, (which is compoſed of vinegar and calx of lead,) a decompoſition or change of union takes place according to the laws of affinity; the vinegar leaving the calx of lead to join with the clay, or more properly the earth of allum; while the vitriolic acid leaves the earth of allum to unite with the calx, forming with it an inſoluble and uſeleſs mixture (61) conſequently what remains, as uſeful, is the vinegar in union with the earth of allum (according to vulgar obſervation and language, ſugar of lead prevents the ſettling which would otherwiſe take place too ſuddenly) but in this mixture there being more acid than neceſſary, expreſſed in chymiſtry by the terms either of exceſs of acid, or a ſuperſaturation of acid, chalk being added, takes hold of it: the chalk at the ſame time undergoing a decompoſition (by the vinegar expelling the fixed air) (62) the efferveſcence which commences, evincing this operation.

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(61) Thus, it is common for the colour at the bottom of the tub to be unfit for uſe. ſee ſomething ſimilar in Exp. 6 in note 40

Whether the neceſſity of this additament was diſcovered a priori, or by chance, or experiment, is no matter; it is certain that without it the colour is not ſo deep. For according to the common mode of proportions, without the uſe of chalk, there is a uſeleſs ſubſtance remaining, increaſing the bulk of the liquor without adding to its efficacy. (note 61) An alkali being added tends likewiſe to take up the exceſs of acid, hence ſome uſe aſh in the red colour.(63)

The reſult, however, being now vinegar and the earth of allum, neceſſarily diluted; when it goes

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(62) Chalk is lime ſaturated with fixed air, or ærial acid. Lime is chalk deprived of it.

In this caſe the ſtronger acid, that is, the vinegar, expels the weaker, that is, the fixed air, and takes its place, according to the 5th rule of affinities in the compendium.

(63) If waters were carefully analyzed before being uſed, ſome would be found fit for black, though unfit for red, and ſo of other colours; in truth, few are aware of the conſequences of an indiſcriminate uſe of hard or ſoft water; in ſhort, it will render the proportions or articles neceſſary at one ground, perhaps uſeleſs at another.—ſee article preceding aſhing and note 37 to maddering.

goes into the madder copper, the union between the colouring matter of the madder and the earth of allum (which forms what is often ſpoken of in this work as a cement) is eaſier affected than if with only a mere ſolution of allum.—Here be it obſerved, a ſecond decompoſition takes place, that is, of the vinegar and earth of allum, by the interpoſition of the third ſubſtance, namely, the colouring matter of the madder or weld, as either is uſed.

The vinegar is likewiſe found to agree better with the thickening than a mere ſolution of allum will, it being in tearers language, not ſo vittry, lumpy or ſpecky; perhaps from not being ſo cryſtalizable.

In making red colour (64) various other articles, ſuch as ammoniac, corroſive ſublimate, tartar, calx of tin; arſenic, zinc, &c. are or have been occaſionally added. When arſenic is uſed, there certainly ſhould be aſh added: Reſpectable colour-makers are however very ſparing in the uſe of theſe articles (note 59.)

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(64) The reader is again reminded colour here is a very improper term.

It is unneceſſary (and in fact for reaſons juſt added, not intended) to enter into a detail of their immediate effects, or the cauſes of them; their chief effects as ſaid already, being as alteratives, (65) but they are neceſſarily ſpoken of here again.

It is, however, juſt intimated that tartar in its union with allum, does not act like ſugar of lead: there is not a mutual decompoſition, though they attract each other; the attraction is neverthe-leſs deſtroyed in the copper, and a decompoſition then enſues of the previous mixture, followed by a union of the colouring matter with part of it.

Calx of tin, ammoniac, &c. in their effects of brightening (as uſually called) are efficacious in conſequence of preventing that cloſe attraction of the madder, weld, &c. to the allum, &c.--- Tartar uſed for yellow has this brightening effect in a particular degree; it likewiſe brightens chymical colours, ſuch as ſolution of cochneal,

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(65) Their attractions to the principal ſubſtance or baſis of the colour is to be known by ſtudying the laws of affinities.

brazil, &c. and in printing kerſeymeres and other animal ſubjects this ſalt is very uſeful. Urine in ſome caſes ſtrengthens the colour; corroſive ſublimate tends to deepen it, but like as with tartar, aſh ſhould be uſed with it. Common experience will ſhew the effect of other ſubſtances, though now few of them are uſed in callico printing, as juſt obſerved. (66)

It is not to a vegetable ſubſtance that the attraction of the earth of alum is confined, it acts readily on animal ſubſtances, as in the inſtance of lakes (ſee note 33) here the alkali ſeizing the ſubſtance ſuſpended in the ſolvent till then, is thrown down. In printing on woollen this circumſtance is very manifeſt: hence it may here be ſaid, that as in dyeing, a ſolution of iſinglaſs, or of glue, added to the decoction of the vegetable ſubſtance, helps the effects by its attraction to calces, which otherwiſe would not be attracted by the colouring ſubſtances. (67)---(See calces further on.)

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(66) Some colourmakers nevertheleſs affect to be wonderfully ſecret in uſe of ſome of theſe. The writer knows of a great ſum being given not far from London, for a reeipe for red, becauſe calx of tin was an ingredient.—ſee notes 35 and 79.

In want of ſugar of lead, it may eaſily be procured by diſſolving any of its calces, ceruſſe excepted, in vinegar.

Concerning YELLOW, &c.

The ſolutions of allum, ſugar of lead, and tartar united, is the agent for procuring yellow from weld; tartar is however not now much uſed. The natural operation here being ſimilar to that of maddering, excepting the colouring matter being yellow inſtead of red. (68) Various articles are ſometims uſed as ſubſtitutes, but none excels it. The New-England oak

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(67) The uſefulneſs of dung, as an animal ſubſtance, helps the colouring proceſs in callico printing.—See dunging.

(68) The action of allum and lime on the colouring ſubſtances is ſimilar to that of lime or alkalies on indigo.—See further on.

If allum be boiled in a copper veſſel, the liquor will be impregnated with copper, which vol. alk will detect.

bark, uſed by many in Lancaſhire may however be mentioned as the beſt.

A weed called by ſome Ladies Bed-Straw (ſee the ſheet with the table for proportions) has had a little undeſerved repute for bringing up ſeveral colours at once: it may nevertheleſs ſerve as a ſubſtitute for weld. The root gives a red.--- Several fields near Bow in Middleſex are appropriated for the cultivation of this plant.

The varieties of drabs, teas, clays, dull-greens, &c. are eaſily procured by varying the proportions of ſumach, fuſtick, &c. as already ſtated.

An orange or ſnuff-colour, is procurable by not letting the maddering come up to a ſcald, ſo that the red is barely produced, and then welding it. It may be ſubjoined, that a repetition of maddering or welding by adding various ſalts or calces to what remains, will produce various effects. Variegated effects are likewiſe to be produced by welding firſt, then printing an after-courſe and maddering it: but theſe, however, are only tricks to be purſued with moderation.(69)

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(69) Such practices helped to forward the failure of Liveſy and Co.—See further on, note 80

Of Colour-making.

It has been obſerved (ſee note 30, maddering) that a philoſophical mind might come near to ſome proper criterion for aſcertaining the quantity of madder, &c. merely requiſite in all caſes. The hint there given may poſſibly be improved by the practice of dyeing, where the weight of the ſtuff that is to be dyed, regulates the weight or meaſure of the articles that procure the dye. There are however great obſtacles to ſuch aſcertainment in Callico-printing: but, if only for experiment ſake, cloth might be weighed before and after being printed, and the difference in weight acquired by printing, made to regulate the quantity of madder, weld, &c. taking into account the dry and wet ſtate of the cloth, the thickening, &c. But, at any rate, the ſuper-quantity of the colouring articles might, by certain proceſſes, be ſeperated from whatever elſe that may neceſſarily be left in the copper of the thickening, ſightening, &c. and the madder, weld, &c. not taken up, be ſeparated in a pure ſtate (this at a future time will probably be ſpecified, though deemed needleſs now, as the agency of chymiſtry muſt be brought in, in a rather particular and operoſe manner. The writer is aware, and has mentioned, (ſee maddering) that, in common, this ſuper-quantity is made uſe of for inferior purpoſes; and even in the colouring houſe in making yellow, &c. but ſomething like what is hinted as above, would be of much better advantage.

Concerning BLUE.

The chief, and, perhaps, only proper agent in the production of this colour is indigo; as woad, pruſſian blue (70) logwood and ſome other ſubſtances, have hitherto not anſwered not anſwered the hopes of any. Woad however is the cloſeſt of kin to indigo; in fact, indigo is obtainable from it.(71)

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(70) Pruſſian blue is iron, in combination with pruſſic acid, which acid has precipitated it from its ſolution. The acid is prepared by calcining animal matters (generally oxes blood) with alkali. The common ſolution of Pruſſian blue is by ſolution of tin or marine acid; ſomething of which kind was lately hawked among London printers as a blue to print with, and called the true Switzerland blue. But the whole proved rather an abortion,—See further on, reſpecting metallic calces and precipitates.

(71) By the agency of lime, or by adding pure alkali to the woad, when fermented with water.

The common ſolution of indigo, or opening of it, as uſually termed, it has been ſaid is with aſh, lime, orpiment (72) and concentrated vitriolic acid: but, it is here further obſerved, that indigo, in order to be diſſolved, muſt be de-

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(72) Forming a liver of ſulphur, which is the true ſolvent.—Livers or hepars being combinations of ſulphur, with alkalies and earths, and the orpiment here which is decompoſed, in the courſe of the proceſſes, contains ſulphur.

The properties of indigo are ſuch, that nature ſeems to have ſet a barrier to any attempt to uſe it like many other articles, when it is formed into the pencilling blue colour; (china blue colour being governed by other proceſſes) ſo as only to require rincing, with all the ingenious contrivances of wired ſieves, agitators &c. either in procuring fine lines, or evenneſs of colour, when the ſhapes are large and frequent (note 39) for as partly obſerved, note 37, till we can either diſplace or deaden the attractive powers of a component part of the atmoſphere, or elſe chain down, as it were, the volatility of a principle in the indigo, we muſt deſpair of having it in ſubjection. The new doctrine, however, of gaſſes, is at preſent employed with ſtrong hopes of uſing it, at leaſt, to more advantage than hitherto.

compoſed, and a ſubſtance which it has acquired, which ſee below, be expelled. Woad, in which putrefaction has commenced, affects this, and at the ſame time gives a blue. The appearance that indigo exhibits (note 37) in ſolution, is its becoming green, or ſhewing a green ſurface with lime, alkali or certain calces: The colouring matter here evidently flies off, and until that takes place it is inſoluble. (*) The copperas and orpiment are ſuppoſed to do this from certain powers of affinity or attraction.

The beſt methods for forming blue vats, according to the moſt reſpectable French chymiſts and dyers, are 1ſt, By macerating the indigo in a ſtrong ley, then grinding it, adding lime and water to it, raking it when the lime is ſlacked, and then adding green copperas or orpiment.--- After this, the indigo (previouſly ground) is to be added, raked and then ſuffered to reſt as uſual. 2nd, method, being more ſimple, is by adding certain proportions of indigo, green copperas, lime and water, and this compoſition, after raking, is fit for dyeing in a few hours.

In theſe and all other proceſſes in which lime and water are uſed, the lime muſt not be too chalky (73) nor the copperas too calcined, and the lime ſhould always exceed; or the ſolution of the indigo will be the more imperfect; neither neither ſhould it be in uſe but a few days, as it then gets weak.

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* Vital air, which the indigo acquires during combuſtion, according to the new theory.—See Berthollet's memoirs.

Immerſing the cloth afterwards in diluted vitriolic acid heightens the colour; it is generally immerſed twice, the firſt time being called roughing, but this commonly hurts madder colours, hence chiefly uſed with china blue colours only, and theſe when dull may be mended by further immerſions. †

To make this blue, ſome make a ſolution of antimony firſt, and add indigo afterwards. A dry preparation in theſe proceſſes as well as in others is to be procured from indigo.

The curious may ſublime indigo, and thereby procure flowers as with zinc, ſulphur, &c. For

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(73) Which will unavoidably be the caſe if kept too much expoſed to the air, by attraction of the fixed air* from the atmoſphere, chalk being lime ſaturated with fixed air, which when impelled by fire, or a ſtronger acid than the fixed air is, is extricated; but which the time afterwards, endeavours to regain. But this attraction if fixed is moſt manifeſt in lime water, and every one knows time gets moiſt ſoon in the air, eſpecially if the air itſelf be moiſt.

* *Which is a weak acid.*

† A blowing day is bad for drying the cloth, as it is apt to ſmudge; but when the blue is once fixed, it is not eaſily moved.

experiments in a ſmall ſcale it may be done in a common flaſk over a common fire, defending the flaſk from the contact of the fire.

To ſpeak of the Saxon blue is hardly worth while, it is ſo very fugitive, being a mere ſolution (if it can be called ſuch) of indigo in vitriolic acid. If this, however, be added to a proper ſolution of indigo, a green may be procured; and if the acid be rather predominant, it increaſes the intenſity.

In blue dipping, if the cloth appear clean and white, as in other caſes mentioned under the ſection of copperwork, the preparation is generally diſpenſed with, on a preſumption the cloth has no oilineſs in it; but this does not always ſeem to be the caſe, and the writer cannot think ſubordinate blue dippers, printers, and cylinder workers, are always in fault, when ſtormont and other cloſe work appears uneven. And he knows, that faults are fewer where preparation is more indiſcriminate. Even for common chemical work, it may be more needful than perhaps many think; for it is certain, that if the aſhing be not properly or ſufficiently performed, the cloth will turn brown in time: and this, by the way, may account for the brownneſs that is obſerved to take place in cloth where chemical colours are brought up in lime water, unleſs it be ſuppoſed that the lime may depoſit ſome of its earth, or ſome ſubſtance that may be in union with it, (as lime itſelf is earth) which in time cauſes that brownneſs. In this caſe, how far an immerſion in ſome acid may diſlodge it the writer will not ſay, but the acetous acid ſeems moſt proper: as to the vitriolic that muſt unavoidably form a ſelenite. (74)

In making paſte colour (75) in order to preſerve certain ſhapes in white on a blue ground;

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(74) A deſideratum in china blue, printing exbiting it, with deep and pale ſhades along with madder colours, without paſting or otherwiſe preſerving it. It is however to be done by certain preſervatives, though not by common paſte; and even a ſtrong blue to be formed by certain prepared vats, ſo as not to hurt the madder colours; and it is well known, the writer a few years ago drew patterns with two blues intermixed with chintz work (the houſe of Aſhby and Philpot had the firſt) but it was deemed impracticable; he however hopes thinks it will not long be deemed ſo.

(75) A compoſition of tobacco pipe clay, and ſoft ſoap.

waters impregnated with ſelenite or other earthy matters, are detrimental. (76) However, in any caſe where the ſoap is decompoſed, the paſte does not work freely. Inſtead of tallow to which it is requiſite to keep a heat continually applied; ſome of the fat oils; butter of cocoa, &c. might probably be uſed to advantage. In wax printing the wax is neceſſarily kept fluid over burning charcoal.

Lemon-juice being made uſe of in ſome caſes to procure ſimilar effects, by diſcharging the colour, it is intimated here how to procure it.

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(76) If vitriol of lime or magneſia be in water, the vitriol unites with the alkali, and the lime or magneſia with the oil, forming an almoſt inſoluble ſoap, floating on the water having the appearance of a curd: hence here cannot be a perfect ſolution of the ſoap.

⁂ A ſolution of ſoap being poured on a metallic ſolution, its acid ſeizes the alkali of the ſoap.

Fat oils and bitumen make a fat varniſh. By combining fat oils with calces of lead, adding a quantity of water and evaporating the liquor, a thick ſyrup is obtained which does not cryſtalize

Expreſs the juice of lemons, of any ſort, ripe or unripe; expoſe it to the ſun till it depoſits a ſediment, filter it till the liquor is clear and ſet it in a ſand bath; change the receiver when the drops are acid: The acid preſerved in the receiver, is to be kept in veſſels ſecured from the air; Or, ſaturate the lemon-juice with lime, waſh it and pour it on a due quantity of vitriolic acid; the liquor poured from the precipitate is the acid of lemons.---*Lavoiſier's Chymiſtry.*

The beſt lime is that what effervesces the leaſt with vinegar, (77) or which mixes quickly with water, and with the greateſt heat.

To get the pureſt lime (though not ſo abſolutely needful in the above-mentioned proceſſes) is by boiling powdered chalk repeatedly, diſſolving it in radical vinegar, and precipitating it by concrete ammoniac. For pencilling blue, pure lime is, however, indiſpenſably needful; in fact, in all the ſolutions of indigo where it is uſed, as is the lime ſo will be the colour.

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(77) Being moſt deprived of its fixed air (ſee note 73) and conſequently there can be little effervescence.

Lime water when uſed to bring up the colour, whether bright green, buff, chemick blue, &c. produces the effect by decompoſing the mixture applied to the cloth: the acid that held the articles in union being ſeparated from it, and the remainder left on the cloth.

From the preceding ſuggeſtions it is inferred, that good black and purple colour is only to be procured from well ſaturated iron liquor: good red, and yellow from pure vinegar and earth of allum; and good blue by the ſolution of indigo with pure lime, aſh, &c. but to enter here into a deſcription of the teſts and analyzation of theſe mixtures would be too complex and prolix, and for reaſons given, it would be almoſt uſeleſs, for it comprizes an analyſis of every article that is uſed both in its ſimple ſtate and when combined with any other ſubſtance. It is, however, certain that no man can properly be deemed a colour maker unleſs he can do it, if only reſpecting the common application of them, ſaying nothing ot thoſe accidents that often confound the beſt colour makers that we have.

Of CHEMICKS. (78)

Metallic calces, precipitates, and certain ſubſtances held in ſolution by acids, are here the common agents. Calces in general have more attraction for, or, perhaps, rather are more attracted by animal or woollen ſubſtances (79) than vegetable, viz.

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(78) The reader is reminded, proportions are intentionally with-held, but particularly in chemical proceſſes; note to prel. ſug. for beſides the reaſons given, he will add here, that thoſe recipes which he has procured, contradict each other. He however would willingly give information of certain venders of them and whoſe indigence it would even relieve.

(79) Bright colours on Kerſeymere, and other woolen matters, are not the beſt on the ſcore of permanency. (note) Brightners however are eaſily obtained, as ſaid elſewhere.

A great ſum (as before intimated) was given for a recipe for red, (at Nixon's, the writer thinks) becauſe calx of tin was an ingredient, which acts as one of theſe brightners

The writer knows of a firſt attempt to print hammer cloths, fabricated with a mixture of animal and vegetable viz. linen, cotton and the like (calces of iron excepted) particularly if ſaturated with an alkali, from their affinity to them, as they leave the acid in which they are ſuſpended, being at length thrown down, (note 33) Or it may be ſaid, the ſolution of any metallic ſubſtance in an acid, produces the deſired effect, by the ſubſtance it is applied to, having a power of decompoſing it and joining the colouring part; therefore it may be obſerved the moſt likely circumſtance in favour of forming chemical colours is the ſolution quitting its acid readily.

Where calces can be introduced along with the ſolvent, ſo as to form an union, it muſt be in conſequence of the article intended to be coloured, having attraction for the calces; and hence the great advantage of woollen printing, as animal ſubſtances

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vegetable matters; but the difference of the ſubſtances not being provided for, the endeavour failed (note 26 and 41) An ingenious artiſt (Naylor) has however done beautiful work on theſe articles, knowing how to provide for the mixture; as well as he has operated on the linings of carriages &c. and he now has deſervedly the countenance of ſeveral of rank and faſhion.

ſubſtances have ſtronger affinity to calces than vegetable. As to the circumſtance of iron-liquor cauſing a black as ſuppoſed by a depoſition of its particles. (note 28) the new idea of a partial ſolution of the cloth may be brought in to aid the operation.

The calces of gold, ſilver and mercury cauſe too much combuſtion to be rendered of proper ſubſerviency; or in other words, their tendency to affect too ſtrongly the articles to which they are applied; while copper, lead, or biſmuth approach the other extreme.

Many calces give a purple; Godfrey among his attempts has made ſeveral fine ones, note 4 to Prel. Sug. Ilet had one before the ſociety for the encouragement of arts; but without undervaluing the labours of any, and Godfrey's reſpectability as a chymiſt is well known, as well as the profeſſional practice of Ilet, and others, unfortunately moſt chemical colours, unleſs they contain within themſelves a proper buoyant, a buoyant or thickning is with difficulty incorporated with them, (note 49) and to temper them like aluminous and other ſolutions, deſtroys moſt of them at once, by the water taking hold of the ſolvent. Even the brilliancy makes them ſuſpected. Another thing is the articles and proceſſes being too expenſive. Further, among attempts of this nature, from the power of the menſtruum, not only an early injury will happen to the cloth, but a chance of the very prints being deſtroyed.(80) Hence ſolutions of animal and vegetable ſubſtances ſeem better calculated for ſervice in general, but particularly for cloth of vegetable fabric.

Various acids (81) will form many precipitates from brazil, but with ſolutions of tin the moſt general

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(80) Among the cauſes of the failure of Liveſy and Co. may be included the irregularity and confuſion Hall occaſioned, as intimated elſewhere.

Brazil ſteeped in certain acids gives out a colour, which precipitated by an alkali, is a lake or inferior carmine

(81) Nitrous acid by its fumes, commonly called ſteaming, gives a dye to ſilk, which when dipped in an alkaline ſolution, is rendered orange; ſome other acids have ſimilar power.

The fuming of dilute nitrous acid, is ſometimes cauſed by its containing iron; which of courſe it much general effects are obtained, and the moſt powerful is the ſolution in aquæ regiæ; on the goodneſs of which much however depends.

Among the effects thus produced, are,

1ſt, Red from cochineal:---The hue to be varied with tartar, ſal ammoniac and other ſalts, [note 41) From ſafflower effects are likewiſe obtainable. Archil in this ſolution has likewiſe conſiderable effect, Among calces, biſmuth may be uſed to advantage. On woollen, as before obſerved, moſt of the calces may.

2. Purple from logwood, and of ſome intenſity.

3. Blue, by the addition of verdigris.

4. A lemon or ſalmon from annatto; and

5. An orange by addition of an alkali. *

6. Bright or pale blue green from verdigris and ſpirit of ſal ammoniac, and ſometimes tartar. Vinegar was formerly uſed till the ammoniac

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much behoves the operator to be very careful of. The acid rendering many ſubſtances yellow, by its contact with them, is from the combuſtion which it cauſes.

Among the new acids that bid fair to be of the greateſt advantage, are thoſe of phoſphorus and borax, from the fixity of their nature.

* The common peach or ſalmon is with aſh and annatto.

Annatto colours with blue will hardly ſtand the lime.

was introduced by a chymiſt at Mancheſter (82) The vol. alk. ſhould however be abſolutely pure; but its great pungency is no proof of that ſee teſts further on. A green has been beforeſaid to be procurable from the proper ſolution of indigo and the Saxon blue. Weld, brazil, aſh, and copperas will form a green, if ſteeped all night, the hue and ſtrength, of courſe varying with the proportions; but theſe decoctions or macerations ſhould be in ſoft water, otherwiſe the ill-effects of ſelenite (vitriolic acid and lime) being decompoſed will be too viſible. Greens are likewiſe procurable by decoctions of various barks and woods by rincing. Among metals whoſe calces are green, nickel ſtands prominent, and is to be uſed to advantage.

Note. Reſpecting the procuring of a green whether from calces of metals, or precipitates, or lakes, from vegetables or animal ſubſtances (note 72) it is obſerved that whatever may be the boaſts of operators, it muſt be allowed, none equal the green procured from indigo and ſubſequent welding: the others in general, being blue or olave greens. In ſhort, nature ſeems to ſay, a ſimple green ſhall not be allowed (83) or in the language of printers. a faſt chymical green: for if we look round to all the operations of nature and art in producing a green, we ſhall find it the reſult of a combination of yellow and blue, and the combination evidently to be traced out, and in many inſtances decompoſed.

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(82) A chymiſt at Old Ford, Middleſex, and a manufacturer of ſal ammoniac, glaubers ſalts &c. likewiſe introduced this article to uſe about London.

French berry yellow, whatever other ſubſtances may be added to it is ſo fugitive that it is rarely uſed now in reſpectable work.

Black of a moſt indelible nature, is procured by diluting a ſolution of ſilver in nitrous acid with diſtilled water, and a little gum; and imprinting it on a cloth impregnated with ſolution of iſinglaſs.

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When vinegar was uſed, it is a certainty the quality of it was not properly inquired into, and without a knowledge of chymiſtry the ammoniac cannot be managed always with certainty. But a deal depends on the nature of the thickening.

(83) In the priſmatic colours, green is the point of contact between the extreme colours, and in this inſtance, ſome analogy may be found between permanent colours produced by dyeing, and thoſe by the priſm: the extreme colours or the moſt ſimple, being red and deep purple: but as the order of the rays approach to the green, they ſeem to coaleſce, till they advance to the green itſelf, which is a direct union of the blue and yellow.

The artiſt mentioned note 79, is in poſſeſſion of the beſt chymick green, of all the writer knows of.

The moſt modern teſt of the ſtrength of a colour is the dephlogiſticated marine acid, (ſee Berthollet's treatiſe on it, and ſee note 21 to Gen. Reflect.) as it operates very quickly, juſt as the air and ſun does in a long time. The change it produces is attributed to a ſlow combuſtion, on the ſame principle as it operates when uſed for bleaching; but in diſcharging colours, if there be iron in them it is not ſo effective.

After the gradation the writer has hitherto affected, from the language moſt commonly in uſe in the printing buſineſs, to ſomething cloſer to that of ſcience, he would willingly riſe to the moſt modern, which is daily getting ground: but this, were he ever ſo competent, he muſt not be diffuſive on yet (84) for, to exhibit now what little he knows of the foundation on which it is raiſed, would be ſuppoſing an acquaintance with principles to exiſt among thoſe to whom he writes, that certainty does not (eſpecially about London) which he here means to mention for the laſt time. However, what he now advances, he does only with a view to ſtimulate thoſe few who know ſomething of the old chymiſtry, to a beter acquaintance with the new.

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(84) In a ſupplement, or elſe in the work hinted at note to prel. ſug. the new terms, the new theories, and new facts, will be exhibited both diſtinctly and incorporated with what is of practical concern, properly explained and exemplified. (Perhaps he may give a ſpecific views of proportions) As to what he has in this work attempted, he could here correct himſelf, eſpecially in ſome practical matters, but he deſires the reader, particularly the critical reader, to note what is obſerved at the back of the dedication,

The greateſt agent in moſt natural operations is called oxygen, and its effects oxygenation; which is, that certain ſubſtances in conſequence of certain powers of attraction or affinity abſorb the vital air of the atmoſphere.

The diminution of oxygen, or vital air, in the oxyd or calx, and of Hydrogen, or inflammable air, in the colouring ſubſtance, is the cauſe of colouring effects. If the oxygen combine with the colouring particles, the hydrogen is retained and conſequently the colour; but if the hydrogen be diſengaged, the carbone, or charcoal, manifeſts

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tion, and what is affixed to the end of the work as an advertiſement; only begging to repeat here the time he had to ſpare from his engagements. (See prelim. ſuggeſtions) was little, he durſt not have riſked expences of editors, reviſors, &c. and laſtly that he had to combat the ill will of thoſe who deemed the publication a mere divulging of practical ſecrets.

feſts itſelf by the colour appearing brown or yellow (this theory is applicable to what is called foxing the purples as juſt ſpoken of) for carbone being contained along with hydrogen in all vegetable ſubſtances, according to the proportion of carbone left by any operation it will be ſeen by the hue it leaves. Indigo has more carbone in its compoſition than muſt ſubſtances.

Thus the proceſſes of aſhing, ſouring, raiſing the colour, fielding, &c. are accounted for by oxygenation having taken place, that is, an abſorption of vital air; and its attendant and conſequent combuſtion of the colouring matter (85) or, in ſome caſes, as in unbleached flax, ſilk, thread, or cloth, what may be called the diſcolouring matter.

Of new terms, the chief acids, vitriolic, marine, and nitrous, are called ſulphuric, muriatic, and nitric. Allum is ſulphat of alumine. Copperas acetite of copper, &c. &c. The combinations of vitriolic acid with various other ſubſtances are ſulphats or ſulphites; marine acid, muriats, &c. (ſee note preceding) as already alluded to before.

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(85) In branning, the bran acts only on the colouring ſubſtance, which an alkali would do, but the alkali would diſturb the acids that hold the colouring ſubſtance, of courſe the whole would be diſturbed.

A Retroſpect, or abſtracted View of the Subject just diſcuſſed, with occaſional Obſervations, and a conciſe Corrollary educed from the whole.

IN the cloſe of the ſection on copperwork, it is obſerved, and neceſſarily here repeated, that all operative effects, however complex they may appear in proceſs, are to be traced to certain ſimple or elementary ſources, depending on principles that give energy to the whole of the operations; and the cloſer theſe principles are attended to, or inveſtigated, operations are to be proportionably ſimplified, and more eaſily and with more certainty carried into (1) effect; thus as

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(1) This conſideration of principles (attempted to be the reigning one throughout the work) may be applied to mental operations, or works of fancy; and is ſo exhibited in the ſection of pattern drawing, where genius is ſpoken of, as that principle or vivifying ſpark (there ſo termed) which is the ſpring of excellence in works of invention.

By the term principles (ſo often mentioned) it is concluded is underſtood, not thoſe ſubtle points that feſts itſelf by the colour appearing brown or yellow (this theory is applicable to what is called foxing the purples as juſt ſpoken of) for carbone being contained along with hydrogen in all vegetable ſubſtances, according to the proportion of carbone left by any operation it will be ſeen by the hue it leaves. Indigo has more carbone in its compoſition than muſt ſubſtances.

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By the term principles (ſo often mentioned) it is concluded is underſtood, not thoſe ſubtle points that as illuſtrating the above poſition, in conſidering the proceſſes treated of in the two preceding ſections, they may be comprized in four parts, which here, ſimilar to the elements of any art or ſcience, are the points from which the ſubſequent operations ſpring, or to which they may all be referred.

Firſt, Cleanſing, or ſo preparing the cloth, that the aſtringent and colouring atoms are not prevented from entering.

Secondly, Expanding the pores when cleanſed, ſo that theſe particles find a ready admiſſion.

Thirdly, Cementing fixing or binding them when entered into the pores when cleanſed and expanded.

Fourthly, Securing or cloſing them in the cloth when thus cemented, ſo that no future natural nor artificial operation can fairly remove them.

Now

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that refined theoriſts conteſt; much leſs thoſe more remote ones, enveloped almoſt in metaphyſical obſcurity. But thoſe only, as obſerved in note 28 to copper-work, from which we can form reaſonable conjectures, as the ſprings or commencements of phyſical operations, and which are univerſally allowed to be valid, and in certain degrees immutable.

Now, in order to enforce a conſideration of theſe principles, and to ſimplify and bring together the operations treated of, it is neceſſary to aſk in general terms, what are the means to procure thoſe effects, and wherein and how far lies the efficacy of thoſe means? or to ſpeak ſtill cloſer to the ſubject, what are the ſubſtances neceſſary to be removed or applied, according to the quality of the cloth, and what are the articles and proceſſes neceſſary to be uſed for that purpoſe?

In the firſt place, the ſubſtance to be removed being allowed to be of an unctuous quality (whether naturally ſo or as applied to the threads previous to weaving, ſee note 12 to copper-work) it can only be removed by applying another ſubſtance that will attract and mix with it, in preference to whatever elſe it may be offered to; and as alkalies when joined to certain unctuous matters, are known to form a ſoap, they are therefore here applied, and a kind of ſoap being conſequently formed, the hot water looſens it, mixes with it, and eaſily removes it; but as the ſalt of the alkali chiefly acts in this caſe, the earth is ſuppoſed to be left in the pores (2) which the water not being deemed able to remove commodiouſly and ſufficiently, recourſe is generally had to ſouring; as acids more readily effect it (3) the abſorbent earths attracting the acid particles from the liquor in which they are ſuſpended, forming a neutral ſalt, eaſily diſſolved in water, and of courſe eaſily waſhed out (4) and the whitening is facilitated from the abſorbent earths being thus thus neutralized.

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(2) Alkaline ſalts are changed into abſorbent earths by frequent ſolutions and evaporations.—See the compendium of chemiſtry.

Theſe operations therefore are deemed needful to cleanſe the cloth, which is only effectually performed, when its pores are ſufficiently clear to receive the ſaline or aſtringent atoms, that are to attract the colouring ones.---See note 29 in copper work.

The above, it muſt be plain, only reſpects cleanſing; the other parts, including the operation of printing, fixing the colour, &c. being dwelt on in other places, the reader is therefore referred to them; but in view of enforcing the idea of conſidering operations as proceeding from a certain point, it may be aſked, how are thoſe various colours and ſhades produced? the anſwer is, by the agency of certain ſaline ſubſtances, (ſee a few pages back) ſuch as allum, ſaccharum ſaturni, &c. which after their application, form an union with certain colouring particles, as of madder, weld, &c. aſſiſted by various and ſucceſſive operations; and which if looked into will be found proceeding from that point into certain direct or lateral connections, that otherwiſe would ſeem confuſed and in many caſes ſuperfluous.

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(3) Hot water, every one knows, will diſlodge oil or greaſe, and, as in this caſe, alkalies and abſorbent earths; but it is not ſufficient, unleſs what diſlodges them retains them, by combining with them.

(4) Mineral acids act ſimilarly to alkalies in removing the brown or unctuous ſubſtance.

All the circumſtances included in this conſideration, cannot poſſibly be ſpecified, but was every perſon, concerned in theſe or indeed any other operations, to enquire from what points they originate, how they branch out, and to what they lead, it would by degrees form an habitual deſire of acquiring knowledge, which when only partially acquired the ſummit is the eaſier to be attained. (5)

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(5) As the writer affects to bring in caſes ſomething in point, he here mentions a circumſtance of a perſon

Concerning aſhing, ſouring, &c. or more commonly ſpeaking, the preparation, it is much ſimplified

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a perſon being employed to repair a copper-plate preſs, having been much uſed to ſuch work; he accordingly took it to-pieces, as the beſt way towards making (as his phraſe was) a good job of it; and after working at it three or four weeks, it was deemed completely in order by a few trials that were made; but that, it ſoon appeared, was far from being the caſe, for though he knew what parts ſhould be together, he did not ſeem to have an idea of tracing their relative connections, as proceeding from the firſt movement; and thus overlooked the firm ſituation the cylinders ſhould revolve in, towards performing with the neceſſary preſſure: for the gudgeon, or pivot-hole, that the pivot or ſpindle at one end of the upper cylinder turned in, was ſo inſecurely placed, that in the paſſing of the plate, it was lifted up a third of an inch, and the conſequence was always evident in the impreſſion, and when the cauſe was diſcovered it was by mere accident.

It would be like affectation to enter here into a copious mechanical diſquiſition of the matter, but it may be ſaid the conſiderations in this caſe, ſhould have been, 1. what the effect required, 2. what the power or velocity to procure that effect, 3. what the reſiſtance pliſied to what it formerly was; (6) and of late years, the proceſſes among profeſſed bleachers, have

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reſiſtance to that power, and 4, what the method to obtain it and likewiſe to ſecure it? and then to have proceeded accordingly.

It is however ventured to obſerve, that in copper-plate printing preſſes, the ſituation of the winch does not ſeem to be properly attended to in working quarter or $\frac{1}{2}$ quarter plates; for, as it is in the pinch that the force is moſt requiſite, the winch (which mechanically ſpeaking is a lever of the ſecond kind) ſhould be ſo fixed, as to be at that time either in the higheſt or loweſt part of the circle which it deſcribes; or, if but one perſon acts, in that point from which he pulls, as in any other the perſons, who turn it, cannot uſe their ſtrength to the moſt advantage, though with the aſſiſtance of the flier; which, by the way, as an aſſiſtant, is contended among mechanics wherein it is ſo; in fact, for reaſons which will not here be entered into, there ſhould be a winch at each ſide of the preſs, but then for whole plate printing, they ſhould not ſtand one up and the other down, as for quater, or half quarter plate work, but rather thus. ⌊

(6) Some at this time lay very little ſtreſs on the utility of dunging, &c.

A groſs error is prevalent among Printers, reſpecting have been ſo altered or retrenched, that in reſpect to practice two elaborate and judicious writers, Dr. Home and Mr. Curry, are growing obſolete

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reſpecting the introduction of dunging, which is, that a Cow having got among goods that were laid to whiten, where her ordure fell they were obſerved to be the whiteſt; but the uſe of dung was common long ago, in many caſes, on the Continent; ſome however think it might be ſpared from Callico-Printing, though ſome imagine it rouſes the colour, but what effect it has is ſuppoſed to proceed from its volatile alkaline quality (as ſaid already). Dogs excrement is uſed in the Levant for brightening the lac uſed in dyeing goats ſkins; and it is common here in the dyeing of thread to uſe ſheeps dung.

Now, according to the intention of this Retroſpect, it ſhould here be aſked, what is the quality of dung? which when anſwered, we may then judge of the propriety of uſing it; as an anſwer, it may be ſaid, it is a vegetable putrefaction; of courſe it is alkaline, and ſhould not be indiſcreetly uſed.—See the ſection of Dunging.

In agriculture, the ſalts in it are ſuppoſed to open the roots of vegetables, and that thereby they are more diſpoſed to receive that humidity from the earth obſolete; (7) to which the great improvements lately made in the cotton manufacture, and that of Britiſh callicoes, have undoubtedly contributed, and even at this time (1790) bleaching is undergoing a conſiderable improvement.(8)

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earth neceſſary for their nouriſhment, and fruitfulneſs.

The above ſuggeſtions may be applied to branning; and if the purpoſe for which bran is uſed, be inveſtigated, other articles would be found as uſeful, which are far more œconomical: but for cleanſing, ſome acidity is required, and there, perhaps, the writer has forced a meaning in deeming it ſouring.

(7) Dr. Home ſays, that among Bleachers by profeſſion, the pieces are firſt ſoaked in warm water; but this is not done now in Lancaſhire. He likewiſe ſays, in ſouring, the foulneſs in the cloth ſo much attracts the acid particles, that the water is taſteleſs; this however is not the caſe in ſouring among printers.—See however note 12 to copperwork, and the article maddering.

(8) The writer now knows a Chymiſt of repute, who ſays, he has diſcovered a mode cheaper and more efficacious than any yet uſed; and the ſame with iron liquor; which will perhaps ſhortly be publickly announced.

The above cauſes a ſuggeſtion, that though the metropolis ever muſt be the center of taſte and faſhion, and though (turning to the ſubject of this treatiſe) ſome Printers about town have had ſufficient reaſon to complain of certain practices of many in the country, but which by a late legal proceſs it is probable will be checked, (9) yet it is in the country that improvements, as

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(9) The caſe was a pattern of Meſſrs Greaves' Newton and Co's being cloſely imitated by Watſon and Co. the fact not being contended, but only a miſconception of the meaning of the act, Lord Kenyon in his charge, ſeverely reprobated the practice of ſuch piracies, as bidding defiance to law, and the protection Parliament had granted to genius and induſtry; and plainly intimated, that if ſuch a caſe came again before him, of an imitation being ſo near the original, as to paſs for it, very little indulgence indeed might be expected.— See notes 13 and 15.

Of the performances in the country, on the principle of expedition, none have more ſurprized Printers about town, than thoſe of cutting and finiſhing various patterns; but reſpecting the mode of doing it, no more, for ſufficient reaſons, will be ſaid, than that it has been frequently done to anſwer a very illaudable purpoſe, and generally with the as generally called, have chiefly originated (ſee note below) though very likely the offspring of ceſſity more than choice, or from the low price

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the power only of printing a piece or two, as the whole was often cut over again, to execute a courſe of work.—See note 32 to copper-work.

An inſtance has been lately given of ſimilar expedition in copper-plate work, in the imitation of a celebrated and truly excellent dark ground pattern, (ſee further on) the imitation being executed in a tenth of the time the original took: the execution, however, it muſt be owned, is neither to the credit of the drawing, nor the engraving, whatever engraving there may be in it; and on the principle juſt reprobated, of ſtill leſs to the publiſher of it; but, notwithſtanding theſe practices, it is plain the infatuation of ſetting up printing grounds in the country on a monopolizing or underſelling plan, has, like other furors, had its paroxyſm (ſee note 13) and the fallacy of the prediction, that the buſineſs would be nearly all done in the country, is now evident enough: as land, labour and proviſions are not to be had on ſuch eaſy terms as formerly; excluſive of the little credit of country paper currency, ſince the failure of Moſney, and the many ſubſequent ones, and the market being overſtocked by the quantity of wretched work, latterly diſembogued by that houſe as well as by ſeveral others.

country work in general is rated at; they have however, from the modes of purſuing them, ruined, or helped to ruin many; though perhaps a few who act with foreſight and on ſome plan, are profitting by them; (10) for inſtance, the greateſt

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(10) Innovations, particularly on a mechanical principle, are ſpreading pretty widely in the country; and machines of various conſtructions are increaſing about town; and perhaps many town Printers will hardly credit that engraved cylinders perform as expeditiouſly as the common pin ones, that a machine for block printing was invented and uſed ſome time, with which any one could print as eaſily as turn a winch, (the ſpecification for a patent was even made out) and that in machine printing, four cylinders may be uſed at once in different colours.

The writer can ſpeak of this with confidence, having the advantage of knowing what has been done, and what has been farther attempted; and was abſolutely in a concern where an almoſt general courſe of printing by machines only, was to have been adopted, a ſyſtem being formed for that purpoſe; but certain conſiderations, among which the idea of ſuch modes being ultimately injurious, from enabling the proprietors to underwork others, operating not a little with him, ſet the plan aſide.

But this is a ſubject neither ſafe nor proper to ſpeak greateſt houſe of all (Liveſy's and Co) where every thing that was deemed an improvement

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ſpeak of, at leaſt for the preſent; unleſs it may be permitted to ſay, (as having ſome relation with it, and being among the cauſes) that a ſpirit of combination has unfortunately prevailed, oppoſition will inevitably follow, and few ultimately will have occaſion to rejoice; for when the neceſſary diſtinction between principals and ſubordinates is deſtroyed, who will willingly enter into a buſineſs liable to be thus cramped, or remain in it unleſs under very particular conſiderations, without ſeeking the means of executing work with leſs manual aſſiſtance? and that ſuch means are to be obtained, the writer, from his own knowledge can ſay, is, under certain circumſtances, to be performed beyond what many imagine, or will perhaps believe; beſides, without affecting a prophetic ſpirit, let it be conſidered, that in the mutation of ſtile or faſhion, callico printing has to fear a decline, or at leaſt a ſuſpenſion; and then the ſpirit of combination muſt evaporate; even at this very time (1790) ſomething may be apprehended from the countenance given by Royalty (and Viee-Royalty) to a manufacture, that for ſome years has been little encouraged.

It is very far from affectation or oppoſition, that theſe was put in practice, and where labour was had at

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theſe matters are freely treated; for it is to be feared that thoſe who boaſt of having carried their point, (which by the bye, a favourable coincidence of circumſtances forwarded perhaps more than wiſdom or ſagacity) are too much blinded by it, to ſee the certain conſequences, that ſooner or later *muſt* follow*, as to their plea on a legal ſcore, it would have little countenance in a court of juſtice, if we may judge by the ſeverity with which ſeveral late combinations have been *treated*, the letter of the law itſelf being directly pointed to inflictions of that nature, without opening for eſcape or evaſion; and why the law is ſo pointed, is on the principle that combinations obſtruct trade: and in this caſe, what maſter Printer can venture to engage patterns, when at the loweſt price, has, to appearance, irretrieva-

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* *When ſubordinates or lower claſſes acquire power in any ſhape, it is rarely uſed with temperance: and in this caſe, it would not be wonderful, if the Congreſs, as uſually called, hindered certain diſapproved maſters from having any men at all; or perhaps ſome of them might be for preſcribing what kind of work they chuſe to print, as well as they have often condemned certain prints; theſe ſuggeſtions are only intimated to the intemperate, as the few intelligent men that are among them, or thoſe that through neceſſity cloſed with the ſcheme, do not need them; and many, it is well known, find it very heavy to contribute to the fund; which, by report, can hardly anſwer the demands on it.*

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when he doubts (which he may now) whether he may be allowed men to work them, or men to even work at all; thus, if the regular channel of buſineſs is impeded, ſtupidity itſelf muſt ſee the certain conſequences; as to the reſtraint about apprentices, it would be proper enough if every apprentice proved to be a tolerable workman, but that is not the caſe with one in ten; of courſe, a proper ſucceſſion of hands is prevented; but, if the aſſociation had been winked at, or if certain exertions for moderating this refractory ſpirit, and procuring an equilibrium of intereſts between maſter and man, had been aided, an extremity of proceedings (which will undoubtedly be the caſe) would have been prevented; however, at any rate, and for reaſons which thoſe who look only as far as a Saturday-night,* cannot ſee or will allow, power, in this inſtance, ſhould be in the hands of the Principal.

At the ſame time let Principals be reminded, as a counter charge, that compacts between them reſpecting journeymen have been broken;† and were any to be made, and confirmed and ſanctioned by law,

various

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* *Though ſome may not be pleaſed at mentioning it, yet great wages is an evil to thoſe who know no uſe of money, but to get rid of it at that period.*

† *In a late trial (July 1790, at Guildhall)* 500£. *damages were given, for one Manufacturer inticing men away from another: heavy damages being directed by Lord Kenyon to be laid.*

bly failed; (11) while its great and avowed rival *ſeems* (ſee however what is ſaid further on) to

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various cauſes will ſtill tend to break them: for when men are wanted they muſt be had; but a junction of intereſts in ſuch a caſe is hard to be formed.—See ſomething relative to this in the eſſay reſpecting maſters and men.

Something on a combinatory principle, has been in agitation among another claſs, but of which no more will be ſaid, than that the writer laments any propoſals ſhould ever be made, to ſell works of genius or fancy at ſo much per inch. *

(11) It is ſaid this place was the means of giving bread to near 20,000 perſons; cloth in whitſtering has occupied ground 12 miles in length, near 300 tables have been employed, and near 40 coppers at work at one time; 6 or 700 cylinders have been cut or pinned; common prints, &c. innumerable; and it is well known, one man, at the beginning, made a decent fortune by the cutting of them; but, as obſerved above, the price of labour was latterly reduced as much as poſſible: by converting (as done at other places) herds of Lancaſhire boors into drawers, cutters,

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* *A Plan of Mr. Lukey's (included in the general one) to excite emulation among Deſigners, merited conſideration; but Maſter Printers and Drapers muſt join for that purpoſe before it can be effected; and being for their mutual credit and intereſt, it were well if they would. It however can never be too late to adopt ſomething of the kind.*

to have hitherto profitted by adopting ſimilar modes; and by attending to quality as well as

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cutters, printers, machine-workers, &c. and the work was latterly proportionably execrable.

Of the failure it may be ſaid, who in times paſt would have believed, or who in times to come will, that a connection reputedly worth above 150,000l. at its commencement, ſhould in a few years crumble under the deficiency of near a million and a half; and that among thoſe involved in the accommodation labyrinth, who fell in conſequence (excluſive of Gibſon and Johnſon) ſome were for 10 or 20,000l. who, comparatively ſpeaking, poſſeſſed little indeed? ſaying nothing of thoſe who lingered ſome time, or thoſe who were more or leſs ſhaken, or may be ſhaking at this moment.

It muſt however be obſerved, that in trying to reinſtate the firm, it was endeavoured to prove that if it were ſupported till affairs could be arranged, there would be a balance in hand of 60,000l. but the attempt was in vain; the anſwer in general being, in effect, that ſuch egregious folly and extreme madneſs had little title either to ſuccour for the preſent, or confidence for the future.

As to the manœuverings to raiſe ſupplies, they were carried to ſuch enormous and unprecedented heighths, branched out into ſuch complicated mazes and ſo finely ſpun, as hitherto to have baffled the quantity, it has in ſome caſes exhibited reſpectable work; but without a compliment to the principal

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powers of a Thurlowe or Kenyon to unravel*, but perhaps it was thought the magnitude of the concern was ſo great, its connections ſo wide and important, the reſources ſo various, and the bank ſo expedient, that it would be upheld in defiance of common contingences; and probably the blow was at leaſt, not ſo ſoon expected.

But whether or not that was the caſe, many muſt ſmartingly remember the immediate effect of the ſhock was an awful gloom, diffuſing itſelf as if credit were at its laſt gaſp; or, as if that ſpecies of honour on which the very exiſtence of Trade, Manufactures, and Commerce depends, had approached its diſſolution; Manufacturers and Traders of various deſcriptions, crouding to town, tremblingly anxious to know their fate; the *miaſma* expanding ſo widely that few in any trading connection knew on what ground they ſtood. The conſequences however muſt tranſmit a warning to future adventurers, how they precipitately adopt ill-digeſted plans, purſue immethodical operations, or execute deſperate reſolutions, eſpecially if on a mo-

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* *At the writing of this, the principle of their fictitious notes was under the conſideration of the twelve Judges.*

Principal, his labour, attention, inveſtigation and ſyſtematical arrangement of the buſineſs, as well as his conception of trade in general, muſt have been very great to reach the height to which he is now arrived; and, judging by what has happened, unleſs vague politics now diſtract his attention, (12) he is the man of reſolution and enterprize, whom other Printers (a very few excepted) have either to fear or emulate.

Q 5 But,

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monopolizing and underſelling principle, or, as if determined either to be the greateſt gainers, or greateſt bankrupts; but in ſhort, of the whole it may be ſuggeſted in a few words, without diſtortion or aggravation, and a lamentable remembrancer it is to hundreds, that its commencement was raſh, its proſecution deſperate, and its termination *** !!!.

(12) Being returned a Member of Parliament. See a Pamphlet aſcribed to him on the national debt. (Something ſimilar was publiſhed a few years ago under the title of "The national debt "no national grievance."

In the political *mania* exiſting among Manufacturers, if Moſney had ſtood, it is probable the competition between it and Bury would have extended

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But, while praiſe is beſtowed where merited, it is here freely ſaid, may thoſe practices juſt ſpoken

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to this object; for as it was, the Principals ſeemed latterly to have loſt ſight of Callico Printing, among their various ſpeculative practices; indeed one of them (Smith) generally had political buſineſs enough on his hands; (his interference reſpecting the Callico-Printers' bill, is as well remembered, as his argumentative powers were acknowledged) but with what propriety Printers, Manufacturers and Tradeſmen in various and extenſive dealings and connections, plunge into the abyſs of politics, beyond what concerns their immediate vocations, is not attempted here to decide; as it may be partly gathered from the rebuff Lord Thurlowe gave Joſiah Wedgwood, in ſaying, whatever he might be as a Potter, he was an indifferent politician.

Of the pamphlet above alluded to, it may be obſerved, that moſt men in buſineſs, in what they write, naturally have an eye to their immediate vocations and intereſts: thus Mr. P——e dwells upon the increaſe of manufacture, but paſſes over thoſe practices that, however they overload the market, leſſen the value of commodities, and is ſilent about that reſpectability which keeps up the ſpirit of any profeſſion, or that is a proper inducement for genius to exert itſelf; for of the vaſt quantities he himſelf ſpoken of, (too notorious to need ſpecifying,) be ever ſtigmatized, diſcountenanced, and repro-

himſelf has thrown into the market, a great part is well known to have coſt him little on the ſcore of deſign and execution, the ſale at the ſame time being undoubted.[*]

And the writer cannot but lament, that while the Miniſter in the late diſplay of the proſperous ſtate of the nation, on opening the Budget for 1790, was attributing it to the increaſe of manufactures, and the conſumption of articles, he was ſilent on the probability of ſome of the manufactories going to decay at the ſame time, as he only regulated his deciſions by the ſtate of the exciſe and cuſtoms; thus to come home to the ſubject, he can only eſtimate the proſperity of the Callico-printing buſineſs by the entries which in this caſe is the ſame, whether work ſells at 10d. per yard, or 10s. (if the ſame kind of cloth is uſed) but it is evident while this has been encreaſing, Printers have been ruining themſelves, by aiming at quantity rather than quality, and lowering the market to get off that quantity. Here the caſe of Liveſy and Co. offers itſelf, for bated, as they muſt *eternally blacken* the character of the practiſer of them, in the eyes of thoſe who have a regard for the preſent and future reſpectability of the buſineſs, or the protection and reward that

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[*] *What a triumph it is, that notwithſtanding this, there are Printers ſtill gaining by a reſpectable line, and though their work ſells high*

genius

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for, while they were deluging the home and foreign markets, they were rapidly declining, in credit at leaſt; and undoubtedly many 1000 yards that paid duty years back, are not diſpoſed of yet: therefore the quantity they did, as appearing in the Exciſe books, was no proof of proſperity, but quite the contrary.—See note in General reflections about the Miniſter's knowledge of the minutiæ of trade.

And, here it is repeated, is the overſight in the Pamphlet, in no notice being taken of that reſpectability which ought to be preſerved in any buſineſs, that by proper means the market be kept open, and that one Manufacturer ſhould not, by illaudable practices, render his profeſſion, and what he produces, of ſuch little value, that at laſt it is neither beneficial nor creditable in any reſpect whatever.

Of the point chiefly dwelt on in the above-mentioned pamphlet, it may be juſt remarked, that national credit, like that of tradeſmen, can only reach a certain height without breaking; and high as England is now in political health, or firm in conſtitution, who can ſay how long ſhe may remain ſo, or that even the means employed to keep her ſo, may not defeat the intent, or that another Gibbons, ſome centuries hence, may not attempt to account

for

genius, and a ſpirited exertion to maintain that reſpectability, has a right, not only to *expect*, but to DEMAND. (13)

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for the decline of the Britiſh Empire? as every century produces great political and commercial Revolutions; and the preſent appears remarkably pregnant.

(13) As there always were, and always will be, men who bid defiance to legal obligations, as well as mere moral ones, thoſe piratical practices, unwarrantable in intention, diſgraceful in execution, and deſtructive in their tendency, will probably never be ſtopped; and the check they have received, (ſee note 9) is far from remedying the evil, for an elaborate pattern of the ſame Parties was ſoon after imitated.—See note 14, and the General Reflections, &c.

Reſpecting monopolizing and underſelling by means of *cramming* the market with low priced work, it muſt inevitably, in the courſe of things, help to bring Callico Printing into diſrepute; and, as it has been ſaid, if it could be ſuppoſed for a moment, (ſee the end of colour-making) a chemical courſe were univerſally adopted, printing would ſoon looſe its repute; ſo here it may be ſaid, without that being the caſe, if what is called faſt-work be brought into ſuch a diſreputable ſtile, ſimilar conſequences muſt happen; and if three or four houſes about town, which in regard to deſign, execution, and an adequate price, keep up its reſpectability, were to decline the buſineſs, the time would

A Retroſpect, &c.

In regard to the buſineſs itſelf, it may be intimated, as a further attempt to reduce the whole of

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would not be far off; but ſuch an idea is unpleaſing, and it is therefore waved.

Perhaps it is fortunate the original plan of the Linen Hall intended to have been opened on the Continent, April 1788, has not been purſued; for certainly it would have cauſed an opening for large depoſits of wretched work; but of that matter, what the writer can ſay about it will be particularly reſerved for another occaſion.*

Having ſpoken of cheapneſs of labour, &c. in the country, it is here ſuggeſted, that what has been done, and perhaps is now doing there, cannot be ſo done about town; for at the great country houſes the ſubordinates have been uſed to look up to the principals as a ſuperior kind of beings; and were therefore held as much as poſſible in a ſtate of mental ſubjection, (perhaps the ſchool at Bury is an exception; though who can judge the founder's views) but ſubordinates about town have higher ideas; and it is ſaid here to a certainty, how diſappointed principals uſed to ſuch implicit obedience, and, procuring on almoſt what terms they pleaſed, the extremity of ſervice at a nod, have found themſelves in attempting the ſame about town; this however is probably gone by, for it is of what has been ſaid in both parts of this work, as much as poſſible into a contracted view (for it ſeems

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* *It need hardly be ſaid, that now, Public Sales are perverted to* partial *inſtead of general accommodation: hence that great ſcheme would have miſſed its proper end.*

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is fact, that at this time (1790) the firſt houſes in the country begin to find, that in the intoxication of temporary gain, they overſhot prudential caution, having nurtured what now proves rebellious; and would willingly compromiſe with town Printers for the ſuppreſſion: and likewiſe finding they have brought the marketable price ſo low, as to deſtroy the balance between that and the price of labour, would gladly join in reducing it, and fixing it by law: (tho' that always renders workmen doubly rancorous againſt Principals) but the evil is of very natural growth, and the folly or impolicy is now ſeen and felt, of putting at one time and another, 50 or 100 rude country hinds to printing, cutting, copper-work, &c. as they now begin to be of conſequence, conſidering themſelves as ſomething more than machines, and pretend to dictate about price, time, apprentices, cylinders, &c. for in compliance with their demands one of the firſt Printers has put down one third of his machines, and ſubmitted to other injunctions; and it ſeems as if apprentices had caught the influenza, for two grounds have advertiſed for about 30 each, that have abſconded, and two others for near 20 each (ſee the Mancheſter papers for June and July 1790[*]) and it is not quite irrevalent to ſay the miniſter is not likely *now*[†] to be threatened ſeems impoſſible to bring it abſolutely to a point) that in the eſtabliſhment and management of it, it is naturally diviſible into three diſtinct parts, *Firſtly*, The inventive and mechanical, as treated of in the firſt part of this work: *Secondly*, The chemical and philoſophical, as diſcuſſed in this ſecond part: and *Thirdly*, (what has not come within the plan of this treatiſe) the trading and commercial, or, in printing for Drapers, the home accounts and town buſineſs; thus, purſuing the ſame mode as in the Retroſpect of bleaching and copper-work, if a train or connection of all the operations in the buſineſs could be formed, it is preſumed it would be ſomething like what follows; for the neceſſary diſtinction above made, prevents a regular chain of proceſs; one part being to prepare utenſils for conveying colour to the cloth, while the other is preparing the cloth to receive the colour; though afterwards, the proceſſes go on in a ſingle ſeries.

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[*] *A threatening Letter was ſent to Roe and Kerſhaw, demanding the ſuppreſſion of Machines. See the ſame papers.*

[†] *See P—le's examination by the Lords and Commons.*

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threatened with their being tranſplanted along with the buſineſs to another place.—See General Reflections, and note 19 to the ſame.

In fact, town Printers have partly to blame themſelves; having firſt ſupplied country ones, by ſelling them their old prints; and old Mr. Peele has often ſaid, the ſending of goods into the country to be whitſtered, forwarded the eſtabliſhment of Printing Grounds.

One diviſion therefore undoubtedly comprehends, with their ſubordinate conſiderations,* thoſe of

1. DRAWINGS, or Patterns, which, whether originals, imitations, or direct copies, the principle conſiſts in adapting them to certain markets.

2. PUTTING-ON, or transferring them to blocks, plates, cylinders, &c. requiring as its principle, an even face, and joining, or ſuch management, that in the end the effect of the pattern is obtained: In this department is included the management of blocks.

3. CUTTING (comprizing pinning, &c.) on the principle of a ſound bottom and clear face.

4. ENGRAVING, requiring diſtinction in the ſtrokes, and depth combined with ſtrength and neatneſs.

The other diviſion comprizes, with the uſual or occaſional intermediate operations of branning dunging, waſhing, pencilling, after grounding, &c. the conſiderations of

1. STEEPING THE CLOTH, or removing dirt or certain ſlight ſtains.

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* It cannot be enforced too much, that every conſideration includes that of what will be the effect at laſt

2. **Ashing**, or removing brownneſs, greaſe, &c.

3. **Souring**, (ſometimes alone ſufficient) for removing greaſe, iron-moulds, ſtains, &c. the principle of which, as well as of aſhing, being to open and enlarge the pores of the cloth, that it may properly imbibe the aſtringent and colouring particles.

4. **Calendering** (including ſtretching, occaſionally ſtiffening, ſtowing, &c.) requiring an attention chiefly to keep the woof, and ſhoot as ſquare as poſſible.

Here the diviſion of proceſſes ceaſe, coaleſcing in the operation of

PRINTING, the principle of which, whether with blocks, plates, cylinders, &c. is properly furniſhing them, and regularly impreſſing the colour into the cloth.* As to colour-making it cannot be brought into either of theſe trains of proceſſes, it ſtanding by itſelf in providing thoſe agents applied to the cloth by printing, for procuring the colour, aſſiſted by the two diſtinct preparatory trains of proceſſes juſt exhihited.

After this junction, the conſiderations then are

1ſt. **Stowing**, or drying or keeping the cloth in a dry ſtate, that the ſaline particles in the colour may not be diſperſed, or as the phraſe is, that the colour does not run.--- See note 34 to colour-making.

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* This being the caſe, the capacities of lads put to the printing table ſhould be better conſidered than they are; and were it done, the dulneſs of journeymen would not be ſo proverbial as it is. In

2. CLEARING, or removing the ſightning and thickning, ſo that as little elſe as poſſible, beſides the aſtringents be left in the cloth.

3. MADDERING, WELDING, &c. or uſing certain ſubſtances, on the principle of their colouring particles being attracted and retained by the aſtringents already in the cloth, as applied by printing.

4. FIELDING, or diſplacing the ſuperfluous particles of colour, by laying down, planking, &c on the principle, that certain effects are procured by friction, preſſure, evaporation, &c.

As to the mode of managing the buſineſs, it would be abſurd and highly preſumptuous in the writer, to advance any thing particular for reaſons repeatedly given, except that to conduct it properly, requires an underſtanding beyond what is conceived as a common one, or even one acquired merely by experience; for leaving it to ſuperintendants is always attended with more or leſs

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fact, every thing depends on it, for unleſs the colour is properly imbibed by the cloth, (as ſaid already) the Drawer, Cutter, and Colour-maker, have laboured to little purpoſe; and the Copperman cannot poſſibly remove nor cover the evil.

leſs inconvenience; and ſervants, who make their employers intereſts their own, or even able to adviſe with, are rarely to be met with; but generally ſpeaking, it may be ſaid, whether in the commencement or proſecution of it, reſources or connections to ſupply work, and conveniences to execute it, are equally of the firſt concern; next to theſe, as far as ſuch a complicated buſineſs will permit, is forming an eſtimate of certain expences, in the price of drugs, labour, and utenſils, as well as the probable profit; which includes the knowledge of the nature and value of drawing, cutting, &c: whatever elſe is neceſſary to be conſidered in reſpect to theory, ſyſtem, &c. is ſo often ſpoken of, that it muſt be needleſs dwelling on it here; it is however earneſtly again recommended to be thought of (ſee note 7 to copper-work, and note 51 to colour-making) that from the complicatory nature of call co-printing, and the difficulties attending the proſecution of the various requiſite proceſſes, (which a ſlight ſurvey even of this tract will evince) it muſt be folly ſuperlative for any perſon raſhly to enter into it (14) on an idea he can in a year or two, acquire a proper knowledge of it; as to thoſe who are in it, it has been repeatedly intimated they ſhould turn their thoughts towards its principles, the parts that compoſe it, and the relation they bear to each other, (ſee note 28 to copper-work, and note 1 of this retroſpect) for merely knowing whether work is done well or not, may be ſufficient for a Draper, or Saleſman, but a Callico-Printer ought to know why work badly done is ſo, and conſequently, how it ſhould be done otherwiſe.

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(14) The numbers who have not ſucceeded, particularly in the country, are ſtrong proofs of this; even at Moſney, not one of the Principals could

Similar now to what is ſaid at the end of the firſt part of this treatiſe (there neceſſarily placed, and chiefly applicable to practice, and what could be partly reduced to rule) are annexed here, a few poſitions gathered from the ſubſtance of the ſecond

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could be ſuppoſed nearly competent, according to what is frequently advanced in this work; but to look round and ſee men, and of ſome underſtanding, ruſhing into a buſineſs abſolutely requiring a junction of mechanical, chemical and philoſophical knowledge; excluſive of the common concerns of all buſineſſes, leaves little room to wonder how ſoon they get confuſed in every ſenſe of the word, and that what they produce is diſgraceful, and of courſe unprofitable.

cond part, as more applicable to theory, or thoſe principles, without which, practice muſt ever be uncertain in its operation, or incomplete in its effects; therefore, be it well remembered, that

THEORY is the BASIS of PRACTICE.

ALL OPERATIONS ORIGINATE FROM A CERTAIN POINT, HOWEVER DIFFUSIVE THEY MAY PROVE AFTERWARDS.

ALL SYSTEMS ARE COMPRIZED OF PARTS THAT HAVE A RELATION WITH EACH OTHER.

PRINCIPLES SHOULD BE CONSIDERED BEFORE OPERATIONS ARE PURSUED.

IN OPERATIONS THERE IS A CERTAIN POINT OF TIME WHEN AN EFFECT IS OBTAINED, AND GOING FURTHER IS SUPERFLUOUS OR INJURIOUS.*

And, as in the poſitions at the end of the firſt part it is ſaid, EXPEDITION WITHOUT PRECIPITANCY IS THE ESSENTIAL SPIRIT OF BUSINESS, ſo here it is ſaid, that

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* See note 16 to Copper-work, and about the ſcald, at the end of Maddering.

CERTAINTY OF EFFECT IN ANY PROCESS IS THE MATERIAL OBJECT, the ULTIMATE POINT, or the GRAND DESIDERATUM to be, IF POSSIBLE, OBTAINED.

Hence, for the laſt time, it is obſerved, that in purſuit of this MATERIAL OBJECT, and, in order to it, to procure a familiary with cauſes and effects, the ſprings of operation ſhould be diſcovered, the channels traced which flow from them, theſe channels re-traced to their ſprings, and the various connections conſidered as intently as poſſible; thus from the conſequences of thinking as well as acting, a capability of looking through every ſtage of proceſs to the laſt will neceſſarily follow, the general cry of the difficulty of managing the buſineſs be partly removed, and a greater CERTAINTY of EFFECT be obtained, with its conſequent appendages of profit and credit, as well as of mental ſatisfaction, (15) and

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(15) If it be not too ludicrous, it may be here ſaid, though ANXIETY be not entered in the Journal or Ledger, yet much may very often be placed to its account.

The anxiety here alluded to, is not ſo

and the writer will go ſo far as to ſay, that under ſuch circumſtances, from the nature of many of the proceſſes, in which fancy, taſte, arts and ſcience, lend their influence and powers, it would (extravagant as all this may ſeem to the mere drudge) be to an active and penetrative mind, a perpetual ſource of rational exerciſe; and ſupply an extenſive fund for philoſophical inveſtigation, and intellectual enjoyment. But, he muſt go further, and ſay, that until men of this complexion, able to render that a pleaſure, which to others, however profitable, is perplexing and burthenſome, are more engaged in it, than now are; little may be expected beyond its preſent confined powers of execution, and relative degrees of effect.

ſo much that which ariſes from the cauſes hinted at, in note 51 to Colour-making, or thoſe that are inſeparable from buſineſs, ſo much as that reſulting from miſtakes in operations. To preſcribe equanimity in ſuch caſes is uſeleſs; the remedy muſt be a preventative; but, nevertheleſs, though a man is not to be reaſoned with in a perturbed ſtate, ſomething may be advanced at other times, which if imprinted on the mind, may prevent or leſſen that mental ebullition. Of which ſee the Eſſay on the relative duties of Maſters and Men to each other.

GENERAL REFLECTIONS,
or
DESULTORY SUGGESTIONS
relative to
CALLICO-PRINTING;
and various articles allied to it;

which may be conſidered either as improveable hints, monitory effuſions, or mere occaſional obſervations.

AS one excitement to forming the whole of this work, was the diſagreeable reflection of many being at the head of the buſineſs treated of, little competent to the management of it, even in its preſent ſtate; ſo the writer would be happy to ſee every Callico Printer, what he ought to be, a man of genius, as well as a man of buſineſs, or any other quality; as emulation would undoubtedly be one conſequence, and the effects of emulation among men of genius, no one can be ignorant of, is aiming at ſuperior excellence over each other, or the exaltation of their reſpective profeſſions; for ſuppoſing, inſtead of two or three Printers maintaining a reſpectability, becauſe it is certain the majority of them cannot reach it, that the performances of every one were equal to the beſt now done; what is it thoſe *very* few who are at the top of the profeſſion would not attempt in order to retain their pre-eminency? (1) and what is it that might not further be done for furniture, hangings, ornaments, and other appendages of Opulence and Taſte, were Callico-printing countenanced (to carry on this illuſion) as the great Colbert, under the auſpices of the great Lewis, countenanced the art of dyeing? (2) and what advantages would not attend it in various caſes, were it rendered as much an object of the Great and Refined, as many articles of faſhion, taſte,

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(1) What is it a certain ſenatorial-Printer would not attempt, were he in a line of commanding a price? for who is more capable of ſpirited? in ſhort, what is it any man would not attempt, whoſe maxim is, "A Man may be a Lord if he will?"—See the retroſpect!

(2) The reign of Lewis XIV. has been deemed the third Auguſtan age; and in Lewis's SPLENDIDLY DESPOTIC reign, ſo emphatically termed by Burke, Colbert had only to ſuggeſt, and Louis commanded it to be done.—See 5th note.

Voltaire makes four ages, i. e. of Alexander, Auguſtus, Medicis, and Lewis.—See likewiſe Gwin on deſign.

and luxury are, though of leſs intrinſic value? as nature, by exquiſiteneſs of execution, might be more cloſely imitated, and fanciful deſigns farther aſſiſted, than they can poſſibly be by the common modes now in practice; but, at preſent, perſons of taſte and judgment in drawing, painting, ornament, &c. (if unintereſted in the buſineſs) rarely find any thing worth their notice in the beſt execution of the beſt full chintz patterns, as being far behind a tolerably decent imitation of nature, either by painting, tapeſtry, weaving, needlework, or even paper printing (which by the way is now in a riſing ſtate) (3) even the neceſſary out-line is a ſufficient bar; and to inſtance an eſſential part of ſuch patterns, a roſe, how little like nature in ſhadow, folding, ſhape and colour, is the beſt three red roſe that ever was, or even can be, printed in the uſual courſe of

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(3) See a French paper pattern of roſes, (the writer thinks imported by Middleton,) which at a proper diſtance has the effect of a painting;—But when had cloth ſuch an effect?

In France, paper printing, in many reſpects, throws Engliſh callico printing to a great diſtance; but it is there made worth employing firſt-rate artiſts as deſigners.—See the advertiſement at the end.

xecuting patterns! perhaps the neareſt approaches to nature in drawing, as far as cutting would allow, and in colour, as far as three reds, three purples, buffs, olaves, and ſo on would permit, have been in various patterns of Kilburn's; (4) and particularly ſo, in reſpect to drawing, in his late excellent dark ground tinted plate patterns; but how ſoon was one ſhabbily imitated, and underſold? (ſee note 9 to the retroſpect) as has been the caſe with many of his coloured patterns; and what is diſagreeable to mention, when ſpeaking of ſuch exertions, probably the retailers' ends were better anſwered; hence, how can perſons of taſte, faſhion or opulence be expected to countenance a buſineſs, while (by way of inſtance) for what ſuch perſons would willingly give five or ſix ſhillings a yard, their very ſervants can have an imitation of, or what has nearly the effect, for two or three ? and what ſtimulas has genius and induſtry to exert themſelves, when exertions are liable to be quickly imitated, moſt commonly in a ſlovenly manner, and ſhamefully underſold ? this alone is enough to quaſh the ſpirit of exertion; therefore the writer confidentially ſays, if any regard be due to the improvement of a profeſſion, requiring genius and a philoſophical underſtanding to conduct, it has a claim on the attention of the higheſt legiſlative powers, that ſuch a diſtinction and regulation be eſtabliſhed (beyond the meaning of the late act) ſo as to annihilate ſuch practices; but this can only be done by preventing that confounding of the excellent and execrable, where inferior work, whether original or imitative, chymick or faſt, anſwers the general marketable purpoſe as well as, or better than, the beſt.---See the retroſpect.

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(4) His patterns for 1790 run chiefly on an imitation of ſea weed, and in effect, at leaſt, excelled what any other printer exhibited, and is particularly noted here, as being an inſtance of what might be done, were Printers not confined to a certain expence; for the cutting in them is ſuch, that no other Printer could or would execute them; and no other Draper, but he for whom they were done, would have dared to engage them: in fact, ſtrange as it may ſeem to many, and incredible to ſome, it is without flattery here obſerved, that out of the great number of Drapers in England, Scotland and Ireland, there is but that one who boldly ventures, in concert with the Printer above mentioned, to ſtrike into unbeaten tracks, and conſequently prevents that *langour* in exertion and *ſickelineſs* of complexion which otherwiſe would be the caſe.

In whatever light this ſuggeſtion may be looked at, by thoſe whom it concerns, or thoſe to whom it is immediately directed, it is affirmed that the great Miniſter juſt mentioned, as he deemed the art of dyeing worth his endeavour to fix on an eſtabliſhment, which comprehended ſuch a diſtinction and regulation (confirmed ſince his time) (5) would no doubt have extended his wiſhes to this object; and the rather, as Callico Printing, by exhibiting figures, flowers, and fanciful objects, on certain articles, inſtead of merely colouring them, is indiſputably a great improvement on dyeing.---See note 49 to colour-making,---and from ſuch conſiderations, however preſuming it may appear to direct any thing like dictation to a Premier, he is notwithſtanding here told, that though an intereſted individual may naturally enough ſay, 'What value I the diſrepute attending my productions, or even the execrations of my practices by poſterity, ſo I gain my peniary ends? yet a Miniſter, from his ſituation as a general Guardian of Manufactures, is bound to take the matter up on a more liberal ſcale, and to regard the reputation and proſperity of the riſing generation, as well as the preſent; therefore, preſſing forward the immediate ſubject of theſe ſuggeſtions, before the Miniſter is again applied to by deputations (6) from town or country

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(5) They are carried ſo far, that Dyers who profeſs dyeing faſt colours, are not allowed even to keep in their ſhops, the drugs uſed for falſe or fugitive ones.—See the end of the ſuggeſtions on Chymick Printing. And this by the way, may ſerve to juſtify what is advanced about Chymick Printing; on the neceſſity of ſome regulation on that point, as well as the apprehenſion of the conſequences of an overflow of inferior and low priced work, though executed with faſt colours.

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(6) And why ſhould not the Miniſter attend to a deputation from thoſe who have the reſpectability of the buſineſs, and its advancement in point of execution, at heart, as well as giving an ear to deputations from others, who have only an idea of doing a great quantity, upon plans calculated for immediate emolument, however highly they may talk of ſinking vaſt capitals, employing 5, 10, or 20,000 hands, forming extenſive connexions, encreaſing the revenue, &c. &c? for, annexing the writers

Callico-Printers, ſor partial or other illaudable pur-

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writer's ideas of improvements to this political one, advancing the reſpectability of the buſineſs muſt advance the pecuniary worth of its operations; and by procuring new and more reſpectable openings for its reception, it would bear higher duties, compenſating for what deficiences there might be in quantity of work, if that ſhould be a conſequence; which however, on the ſuppoſition of ſuper demands only for what is ſuper-excellent, would have little to do with what may be done in common, as is at preſent.

Beſides, as ſuch an improvement would require the moſt reſpectable perſons to carry it on, there would not be the probability of the Revenue being defrauded, as frequently done by indigent or deſperate adventurers; and which many probably ſuppoſe is oftner the caſe than it is, when work is ſold in the ſhops for hardly more than the prime coſt of the cloth, every one not knowing why it can be ſold ſo.

(☞ Whenever improvements are ſpoken of, it is begged to be underſtood that the uſual courſe of practice ſhould firſt be rendered certain.)

As to what is ſaid of a Prime Miniſter's knowledge of trade (if ſuch a topic may be here ventured purpoſes, let him be here informed, that a profeſſion, which is a great ſource of revenue, inſtead

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tured on) it can only be on a general ſcale, as he cannot know much of the minutiæ of it, and much leſs of particular points, where every individual is differently intereſted and circumſtanced, from each other;[*] and in this caſe it will well admit a query (ſome may think not) whether thoſe deputies from the country, when cloſeted with the Miniſter, a few ſeaſons back, were as ready in explaining to him the nature and conſequences of thoſe practices that cauſed the Town-Printers to apply for a remedy,[§] as they perhaps were inſtead of being properly nurtured, is not only kept

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[*] *It is juſt remarked, as appoſite to this obſervation, as well as relative to the ſubject of this work, that, at the late trial about copying a Pattern, a common Putter-on muſt have ſmiled at Mr. Erſkine's attempt to inform the Jury how patterns were transferred to the block.*

[§] *It can be ſaid, that thoſe whom ſuch practices have particularly injured, are not ſolicitous about what printing is done in the country, ſo it were but done upon that principle of honour which ought to actuate Tradeſmen, as well as any other claſs; and as a proof of the above ſuggeſtion, it is on record, that on the late trial, Lord Kenyon paid high compliments to the honourable behaviour*

back

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were quaint, fluent, diverſified or energetic, on the injury they might receive from (innocently to be ſure) printing a pattern likely to be conſtrued a copy?

Note, It is begged to be obſerved, that it is not becauſe the practices often alluded to, are execrated, as done by this or that particular perſon in the country; ſince the firſt Printer, Draper, or any other concerned in the buſineſs about town, would have been treated juſt as freely in a ſimilar caſe; for whether in Town or Country, he only is pointed who ſpiritedly and honorably holds his ſituation as a Tradeſman, or as daſtardly and diſreputably contaminates it. Sheer neceſſity may perhaps plead for indulgence, and on that ſcore pity is due rather than indignation, and pity is beſtowed.

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viour of the Proſecutor, on the conciliating compromiſe that previouſly took place between the parties; evincing that the Plaintiff only wiſhed his "excluſive right" to be legally *aſcertained.*

back from gaining maturity, but even its preſent ſcarcely budding ſtate, has been and is attempted* to

be

ſtowed.—See note 51 to Colour-making. And well would it be for many, into whoſe hands theſe ſuggeſtions may fall, if they prevent their being added to the liſt of thoſe active or paſſive underminers and debaſers of that reſpectability in operation, and that liberality in dealing, which is the proper foundation and prop of any profeſſion, trade, or manufacture whatever.

Of piratical or invaſive depreſations, the late adjudicated repulſe (ſee note to the retroſpect) adds to the triumph of legitimate exertions; and genius and induſtry may look forward with a hope of proper encouragement and protection; for in this caſe it may on an equitable principle be ſaid (and Lord Kenyon's oral teſtimony (ſee note 9) was to that effect) patterns ſhould be conſidered like literary property.

* It is ſaid "attempted" becauſe all have not ſucceeded. The firm of Liveſy & Co. muſt never be forgotten, and as yet may be ranked firſt among monſters of this kind; being equivocal in its generation, miſhapen at its birth, irregular in its accretion, and premature and infectious in its diſſolution.—See this retroſpect.

be nipped and debaſed, by certain individuals, in view of making that profit in a few years, which ought to be a patrimony legally deſcending to after-ages; as well as preventing it from rivalling moſt other profeſſions depending on the exertions of genius, by bringing it entirely under marketable conſtraint:(7) let him likewiſe be told, it was undoubtedly in this light that the great Colbert would have viewed it (making allowance for local and temporary circumſtances) ſince he acted not as if he conſulted a few intereſted individuals, or as to throw immediate riches into the Treaſury, much leſs as if he wiſhed to *force unnaturally* any art to its higheſt ſtate, for the pride of beholding it ſo himſelf, no matter how ſoon after his time it withered; no, that admirable man was ſatisfied with the dawn of ſuch a proſpect; he was content to plant the arts in ſuch a ſoil, that the roots might take firm hold, and the growth be natural, though it might require ages to bring the fruits to their higheſt ſtate of cultivation; or before individuals, the nation in general, or the world at large received emolument or pleaſure from them.

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(7) *Mere mechanical or manual operations perhaps are proper to lay under ſuch conſtraint; thus the plain cloth as being a mere piece of labour may be under ſuch regulations; but when an excellent piece of fancy is exhibited, it ſurely ought not to come under marketable or meaſureable regulations, or at leaſt it ſhould be conſidered as a diſtinct article.—ſee the end of note* 10 *about combination. in the retroſpect.*

Being on this ſubject of improving the profeſſion treated of, it is intimated, that ſome years ago, an artiſt of repute (Mr. Edwards, F.S.A.) was employed in painting flowers, &c. as patterns for working furniture, &c. for the Queen; now here, looking forward in an effervefcence of hope, for the exaltation of Callico-Printing, what would not a high price (ſuppoſe it is ſaid 30 or 40 ſhillings per yard) enable an ingenious Printer to perform, by uſing a greater number of ſhades of colours, more blended, or leſs abrupt in their gradations and tranſitions, with the pencilling applied to more advantage in attempting to imitate, on various materials, patterns ſo drawn and coloured? it is ſurely to be inferred, he could do ſomething that the firſt Artiſt in the kingdom would applaud for its effect; and a ſuggeſtion is preſumed on, that Royalty only waits to know ſomething could be done for furniture, ornaments, &c. to match theſe paintings; which being known and noticed, no one will diſpute the influence ſuch notice would have on the ſubordinate degrees of rank and faſhion; and then (ſtill indulging a deluſive hope) from ſuch an operoſe mode of execution, elevated degree of effect, and proportionate value of the performance, the Artiſt above-named, and others of acknowledged capability, would have that juſtice done to what he or they could produce, not poſſible to be obtained by the preſent higheſt efforts! then would the uſual uncouth imitation of nature, the reſtricted diſplay of fancy, the unmeaning appearance of what are even called good patterns, and that criterion of excellency by what will ſuit the market, be ſuperſeded by performances, that in effect, would be compatible with nature, taſte, and propriety, and accordingly would be judged by a ſtandard juſt and immutable, totally diſtinct from that of the market, or the caprice of the day! and then would commence an æra in the hiſtory of Callico-printing, honourable and celebrious to the commencers, and ſuper-eminently reputable to every one concerned in the operation, or in the diſpoſal of what may be performed!

Before the cloſing of this digreſſion, it may be mentioned that an eminent Printer (Arbuthnot) had a pattern cut for Queen Caroline, but though elaborate and well executed, it was in the common ſtile of effect, with 3 reds, 3 purples, an outline, and ſo on, and produced by the uſual and uncertain courſe of proceſs; but this the writer cannot help ſaying is what remains, not only to be rendered more certain in operation, but, to be exceeded in effect; and muſt be exceeded before Callico-printing can approach to even a very humble degree of perfection.

But, notwithſtanding what has been ſaid, it is too obvious, that the ſettled œconomy of the market, which ſays nothing beyond ſuch a price will ſell, is the moſt inſurmountable obſtruction to any conſiderable improvement in execution and effect, or even to equaling what is done on the Continent; for the moſt elaborate of our work, that, as the phraſe is, will pay, is only an approach towards the excellency of our neighbours.(8)

Another

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(20) It is known ſuch work is done on the Continent, that, according to the price of labour here, would

Another impediment reſults from the common idea received among many Printers, that rendering

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would require 12 or 15 ſhillings, or more per yard, to execute, if it even could be done; *but many Drapers look now more for profit from bargains than from a regular cuſtom of giving ſo much for printing, and advancing it on the buyer; and as this is an irregularity that muſt be removed, before an improvement can take place, it would be beginning a new æra in trade, and new modes of conducting it: and poſſibly, notwithſtanding what is ſaid note 51, *ſome* Drapers, in their connections with *ſome* Printers, would not wiſh work always to be ſo well done, as not to have occaſion for a Damage-book. —See the laſt note but two to Putting-on.

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* *It is particularly in the article of pencilling that the beſt Continential work excels ours (ſee Pencilling, Vol. I) but why the cutting and printing ſhould, is not ſo clear; ſome late efforts, however, ſhew emulation is not wanting, but to effect an equality; the tyranny of the market muſt be cruſhed in certain caſes, as above alluded to.*

The above is applicable to paper printing on the Continent, (as before ſpoken of) but what is imported not being under a marketable controul, no more than Foreign prohibited Chintz, it can command a proper price, and is therefore in requeſt by the opulent.

dering operations cheap, eaſy, and expeditious, are the only points proper to be deemed as aiming at improvements, from being of immediate pecuniary conſideration (9) beſides, it is a very difficult matter to get journeymen out of an old track.

In

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(9) This it is granted is ſo in this ſenſe, but then the conſequence is lowering the price of the articles, which (as often particularly dwelt on) ſtrikes at the very root of that reſpectability which only can render Callico-printing more worth the notice of the opulent and faſhionable.* But according to the writer's idea of improvement, totally the reverſe of that mentioned above, the conſequences would be a greater demand for works of genius, an increaſe of mechanical and manual operation, and a more extenſive requeſt for utenſils, drugs, &c. with a ſufficient inducement for men of ſcientific knowledge, to make proper experiments on articles not in common uſe, at leaſt in printing (ſee the notes at the end of the account of Colouring Drugs, and the end of the Retroſpect) for thus it was, by calling forth the powers of Philoſophy and Genius, in conjunction with the knowledge of the mere Practitioner, that the illuſtrious

Patron

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* *This deſtructive principle, the writer is ſorry to ſay, ſeems to cruſh any further progreſs in that elegant improvement, copper-plate printing.— See note* 10 *to the retroſpect.*

In another light, a great hindrance lays in the lukewarmneſs with which Government liſtens to propoſals of countenancing any art, unleſs they tend to an immediate increaſe of revenue, or at leaſt do not interrupt the channels of it.

From theſe conſiderations, enthuſiaſtic as the writer may be in his wiſhes for the exaltation of the profeſſion in which he has a concern, it is feared, that what has been advanced muſt remain an ideal proſpect little likely ever to be ſubſtantiated; or be conſidered as an airy excurſion, productive only of a deluſive hope, or an imaginary advantage; and as thoſe who are particularly cramped and injured by piratical and debaſing practices, can do little more than complain, ſo, in reſpect to improvement, whatever may be ſaid for bringing the uſual courſes of operation into more certainty of effect, the buſineſs muſt nevertheleſs remain in this reſtrained and imperfect ſtate; which ſtrictly ſpeaking, is, that two

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Patron and aggrandizer of the arts, above ſpoken of, ſo advanced the art of dyeing, as to give France that pre-eminence in it, which ſhe even retains to this day.

two or three can command a price to enable them to execute decent work (which is only ſo in a comparative view,) and the reſt fill the market as well as they are able ; and thus, ſeaſon after ſeaſon, Calico Printing retains the ſame complexion, only the features are now and then a little altered, and frequently diſtorted.

However, according to the mode the writer affects of bringing what he advances to a point,* ſo here it may be ſaid that

The improvement of any profeſſion depends on a knowledge of its principles, and the application of them to practice.

Increaſing the reſpectability of any profeſſion increaſes its intrinſic value.

Under-working, under-ſelling, and piratical practices, are, on the contrary, deſtructive, or ſubverſive of it ; and this conſideration comprizes, the uſual conſequences of adopting cheap and expeditious modes of operation.

Turning now to the treatiſe itſelf, the writer is aware it may be ſaid by ſome, that what he has propoſed (and what he may offer) is unattainable by the generality of thoſe to whom addreſſed: and even romantic in ſome caſes; or elſe that it does not give information ſuch as many expect, who think nothing but practical directions can or ought to be ſpoken of:---to the firſt remark he can only ſay, he certainly attempts to go out of a beaten track; to the other, (as often repeated) it is as little in his inclination, as in his power, or perhaps any other perſons', to exhibit ſuch directions; his intention being to purſue a middle courſe, offering the chief of what he ſays, not to amuſe novices, deceive the credulous, or oppoſe the reaſonable, but as almoſt mere matter of reflection, to thoſe who are in a certain ſtate of practice; as well as earneſtly recommending it to thoſe who may be inclined to enter into the buſineſs, to conſider the nature of it; or if determined to enter, to be equally aware of the difficulty of conducting it.*

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* See the ends of the firſt and ſecond volumes.

Whether what he advances under either idea, is equal to the intention or not, he will not uſe any thing like the inſipid hacknied apology of "leaving it to a candid Public to determine," but he will venture to ſay, that as *his* higheſt idea of the uſefulneſs of this work, is the probability of its rouſing reflections on the principles of

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* See note 7 to copper work.

Callico Printing, which otherwiſe might have lain dormant, his views muſt appear as tending ultimately to encreaſe it in beauty, taſte and expreſſion. This however, it is enforced, cannot be attained till a philoſophic ſpirit is rouſed and diffuſed among Callico Printers in this country, (which if theſe humble efforts may any way aſſiſt, the writer will be amply conſoled for any treatment they may meet with) and as he thinks he could point to two or three, whoſe latent powers only want rouſing, it is here diſtinctly intimated* that if modern philoſophy be called in to aid what is already known and performed (21) it will appear it does not only eſtabliſh theory on grounds more directly applcable to practice, but

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* It being only caſually mentioned in this work.

(21) See Delaval on Colours.—Berthollet on Acids—Bergman on Indigo—but ſee eſpecially the annals of Chymiſtry.

Mr. Delaval's doctrine is, that colour is produced by light tranſmitted through tranſparent particles, from its reflection on a white ground or medium. —In Berthollet's memoirs, are particulars reſpecting the dephlogiſticated marine acid, of wonderful efficacy in ſolutions, Bleaching, clearing the ground after boiling off, a teſt of the fixity of colour, &c. &c. —It is however as yet little uſed in England, in fact, a Revenue concern, that formidable *Remora*, is againſt it. (See likewiſe Nicholſon's Elements.)

Of the diſcoveries reſpecting air, much ſurely but to render practice itſelf more ſimple and efficacious; and not only detects and removes impurities and imperfections in articles that oppoſe the ſevereſt common teſts; but analyzes, rectifies and applies them beyond conception or belief: In ſhort, it rivets ſpeculation with practice, and the agreeable with the uſeful.

But

(as obſerved in the article of Maddering) might be turned to advantage. Fixed air having the property of renovating certain vapid liquors, of keeping meat ſweet a long time, giving water a ſparkling appearance and a moſt lively taſte, as well as ſuperlatively purifying it. (To convivialiſts it may not be inexcuſable to add, that the beverage of punch is much improved by it.) The inference, however, to the Callico-Printer is, that water any how purified and joined with ſalts equally pure (note 36 to maddering) muſt be inconteſtably advantageous in colour-making, as the water likewiſe muſt be in bringing up colour. And every Printer has by him, the principal ingredients, viz. chalk and vitriol.*

⁂ An odd idea is adopted by ſome, that the Indian faſt colours are raiſed by ſand; ſome add the ſun; of this, the writer has often enquired, but what *he* has heard is too abſurd to repeat.—In truth, the principles of Indian faſt colouring proceſſes are like ours, for no other is known; and as they have exiſted ſome thouſands of years (note 40 to colour-making) ſo there is no appearance of their ever being otherwiſe. A deal too is vaguly ſaid of all the colours being put in with pencils. But this will be diſcuſſed in a hiſtory of Callico-Printing.

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* *It has been mentioned how needful a ſtil would be in a colour-houſe. Chemiſts in their proceſſes are particularly careful in this reſpect, and why not callico-printers, dyers, &c.?*

But while thus paying tribute to the exertions of philoſophy, may the writer juſt glance at conſequences which philanthrophy, however it may admire thoſe exertions, cannot but deplore? namely, the depriving many of their (perhaps) only means of ſubſiſtence, and exciting them to acts of turbulence and deſperation(22) and is the rather mentioned, as the preſent diſturbances in the Callico Printing buſineſs are partly owing to ſuch cauſes.(23) Hence, at any rate, in order to compenſate, in ſome meaſure, for ſuch partial injury, by inſtituting ſomething generally advantageous (as often enforced) the improvement of effect, and procuring new and more reſpectable channels for diſpoſal, in all poſſible caſes, ſhould be always kept in view.

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(22) Sir Richard Arkwright is ſaid to have cleared 50 or 60,000l. per annum by his Cotton Mills; but how fared it with the hundreds "turned over to Providence" by the invention?

N.B. A work is juſt publiſhed on the ſubject of granting patents.

What was it the ever to be execrated Firm of L——y, H——e, A——e, S——h and H—ll, wiſhed to do with machine printing? (note 11 to the Retroſpect.*)

(23) By Cylindrical printing. The report of a Patent for printing green (as has been mentioned) has cauſed a ferment among Pencillers: and ſo might the new mode of Bleaching above ſpoken of, from

* *One execrable attempt (rather extraneous here) not univerſally known, was to draw a certain Printer in Surry (ſee note 4) into their connection, not a month before they failed! It was however treated deſervedly with the higheſt diſdain.— Lay and Adams offered the ſame perſon 500l per annum to draw for them juſt before their failure:—Was this folly or any thing worſe?— See note 50 to colour-making.*

May it likewiſe be obſerved, though dwelt on elſewhere, that, as merely practical men in extenſive buſineſſes, are more alive to immediate "Loſs and Gain," (like Miniſters to certain ſources of Revenue) than to diſtant advantages, which require deviations from eſtabliſhed modes of practice or ſupplies, the greateſt diſcoveries ſometimes produce only a tranſient blaze, and are, alas! conſigned to oblivion, unleſs accommodated in ſome degree to what is already in practice. In ſhort, as the mere practitioner cannot

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from the idea of its rendering watering, &c. unneceſſary, have ſome effect on Fieldmen.—See ſimilar thoughts where ſpeaking of chemick printing in the ſection of colour-making.

Of the diſturbances above alluded to, (allowing the above cauſe as ſome extenuation of them) it is juſt ſaid here, (ſee note 10 to the Retroſpect) while funds are ſupported, and the diſtinction of fair and foul ſhops retained; while different Maſters have different intereſts, and ſome actually benefit by the diviſions, it is impoſſible to conceive any end but a ſelf-deſtructive one, or until the members clearly ſee the evil conſequences, as above referred to, or at leaſt hinted at, or when it is taken up by the legiſlature, in an alarm for the revenue.

cannot underſtand the language of theory, till by gradual information his doubts and prejudices are removed, it is an overſight in ſcientific writers (with trepidation it is ſaid) to publiſh reſearches only as theoretical; greater, if announced applicable to practice with no practical matter incorporated with them; but greateſt of all, openly to avow a total ignorance of the practice of what they are offered to improve; as that at once precludes further notice from the merely practical man, who looks for practical information.(24) But, notwithſtanding theſe and all other impediments, and ſurely it is but fair to ſtate them; if a proper emulative ſpirit be but once raiſed, the writer ſtill hopes, deluſive as he may repreſent his hopes, he ſhall ſee London Callico-Printers' names in the liſt of the Royal Society, as well (with ſome little reproach to London Printers be it ſaid) as there are two or three country ones in that of the Mancheſter Philoſophical Society.---That he ſhall ſee practice grounded on philoſophical principles; and conſequently

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(4) As for inſtance, will not a merely practical Dyer rather turn to the tranſlation of Hellot by Haigh, a profeſſed dyer, than to a late excellent one where the tranſlator avows his ignorance even of common technicals?—See likewiſe Dr. Eaſon's paper on bleaching. Vol. II. Mancheſter Phil. Tranſ.

ſequently rendered more certain and of better effect.---That he ſhall ſee this combination of Theory and Practice patronized by a Premier and vivified by Royalty ;(25) and that then he ſhall ſee England, as ſhe excels all other nations in arms and commerce, likewiſe excel, among other arts, all other nations in

THE ART OF CALLICO-PRINTING

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(25) A premium coming from a Royal ſource, and adequate to the expence of the attempt, would go much further towards improvement than the premium for patterns. For one excellency there, is adapting them the beſt to the preſent reſtrained mode of execution ; but as this would much improve that mode, drawings would not be under the reſtraint they now are.—(See the end of note 9 to the retroſpect) and then Engliſh Artiſts, in their deſigns, would find inducement to emulate French ones. In fact, reſtrain in this firſt ſtage precludes excellency in the ſucceeding ones. (See notes 3 and 20 to this ſection) and until it be remedied, Engliſh Callico-printing will ever be behind that on the Continent, eſpecially what is *now* (1791) attempting at Juoy, near Verſeilles in France.

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